# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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|---|---|
| **Hatchery Program:** | Warm Springs National Fish Hatchery |
| **Species or Hatchery Stock:** | Warm Springs River Spring Chinook Salmon |
| **Agency/Operator:** | United States Fish and Wildlife Service |
| **Watershed and Region:** | Deschutes River, Oregon, Mid-Columbia River |
| **Date Submitted:** | 10/10/02 |
| **Date Last Updated:** | 10/10/02 |

# SECTION 1. GENERAL PROGRAM DESCRIPTION

**1.1) Name of hatchery or program**.

Warm Springs National Fish Hatchery (NFH) Spring Chinook Salmon Program

**1.2) Species and population (or stock) under propagation, and ESA status**.

Warm Springs River spring Chinook salmon (*Oncorhynchus tshawytscha*), unlisted

**1.3) Responsible organization and individuals**

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**Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:**

Confederated Tribes of the Warm Springs Reservation of Oregon- fisheries management
USFWS Columbia River Fisheries Program Office- fisheries technical support
Oregon Department of Fish and Wildlife- co-manager of fisheries

The United States Fish and Wildlife Service (USFWS) recognizes that the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) have the principal management responsibility for fishery resources on the Warm Springs Reservation. The Service and the Tribe have a Memorandum of Understanding and an agreement that the operation of the hatchery is to be compatible with and compliment the Tribe's fishery management goals.

**1.4) Funding source, staffing level, and annual hatchery program operational costs.**

The Warm Springs NFH is fully funded by the USFWS. The hatchery has a staff of six full time employees and has an annual operating budget of $538,000.

**1.5) Location(s) of hatchery and associated facilities**.

Warm Springs National Fish Hatchery is located at Rkm 16 of the Warm Springs River, within the Warm Springs Indian Reservation. The Warm Spring River enters the Deschutes River at Rkm 135, which in turn enters the Columbia River at Rkm 329. The hatchery site lies in Section 24, Township 8 South, Range 12 East, Willamette Meridian, Oregon. Shitike Creek enters the Deschutes River at Rkm 174 after flowing approximately 61 km from its headwaters near Mt. Jefferson.

**1.6) Type of program.**

Integrated Harvest

**1.7) Purpose (Goal) of program.**

The goals of the Warm Springs National Fish Hatchery (NFH) spring Chinook program are as follows:

1.) Augment wild fish runs in the Warm Springs River in order to provide a sustainable harvest of hatchery spring Chinook salmon for the CTWSRO.
2.) Restore spring Chinook salmon populations in Shitike Creek.
3.) Research techniques for integrating wild and hatchery fish in a way that maintains the biological and genetic characteristics of fish populations in both the hatchery and stream environments.

**1.8) Justification for the program.**

In 1959, the USFWS, responding to a request by the CTWSRO, began investigating salmon and steelhead enhancement possibilities on Warm Springs Reservation waters. In 1966 Congress authorized the construction of Warm Springs National Fish Hatchery (NFH) in order to enhance anadromous fish runs in Reservation waters and meet the future needs of the resource as well as those of the Tribe. Full production at the hatchery began in 1978. The USFWS and the CTWSRO have cooperatively managed the Warm Springs NFH in a manner that will provide harvest opportunities for hatchery spring Chinook salmon while protecting wild fish populations in the subbasin.

## 1.9) List of program "Performance Standards".

See Section 1.10

## 1.10) List of program "Performance Indicators"

| **Benefits**<br>**Performance Standards** | **Performance Indicators** | **Monitoring and Evaluation** |
|---|---|---|
| **1)** Life history characteristics of wild and hatchery fish do not significantly diverge. | Age composition, body size, sex ratio, juvenile migration timing, adult run timing, and spawn timing of wild and hatchery fish are similar. | A subsample of wild and hatchery fish are biosampled in order to collect length, age, sex, and coded-wire tag information for adult fish. The USFWS operates a fish barrier dam and adult fish ladder adjacent to the fish hatchery on the Warm Springs River. Approximately 10% of the wild run and 40% of the hatchery run are sampled at the hatchery. The CTWSRO operates a migrant traps downstream of the hatchery on the Warm Springs River and near the mouth of Shitike Creek that monitor juvenile outmigration timing of wild and hatchery fish. |
| **2)** Broodstock collection methods maintain the run timing of wild and hatchery spring Chinook salmon. | Adults collected for broodstock are collected proportionately throughout the run based on wild stock run timing. | Run timing of wild spring Chinook salmon is monitored at the hatchery fish ladder. Broodstock for the hatchery program are collected based on historical run timing averages of the wild run. |
| **3)** Produce spring Chinook salmon for harvest in treaty and non-treaty fisheries (U.S. v Oregon). | Contribution of Warm Springs NFH spring Chinook salmon to fisheries in the Deschutes and Warm Springs rivers. | Creel surveys conducted by the CTWSRO and the Oregon Department of Fish and Wildlife (ODFW), coded-wire tag recoveries, and hatchery returns are used to estimate the contribution of Warm Springs NFH spring Chinook salmon to various fisheries. |
| **4)** Surplus hatchery spring Chinook salmon are available for outplanting in underseeded habitat on the Warm Springs Reservation. | An average of 200 adult Warm Springs NFH spring Chinook salmon are outplanted into Shitike Creek annually. Outplanting was initiated in 2001. | Adults are selected for outplanting in Shitike Creek at spawn time in the hatchery. Redd surveys, radio-telemetry, genetic surveys, and juvenile monitoring will be used to evaluate the contribution of Warm Spring NFH spring Chinook salmon to natural production in Shitike Creek. |

| **Benefits**<br>**Performance Standards** | **Performance Indicators** | **Monitoring and Evaluation** |
|---|---|---|
| **5)** Maximize survival of hatchery spring Chinook salmon at all life stages using disease control and disease prevention techniques. | Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy. | Specialists from the Lower Columbia River Fish Health Center (LCRFHC) will inspect adult broodstock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, the LCRFHC will recommend remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. |
| **6)** Release healthy, functional smolts from Warm Springs NFH. | Annually release up to 750,000 marked smolts from Warm Springs NFH. | Three to six weeks prior to release or transfer, 60 fish from each lot will be given a health exam by fish health specialists from the LCRFHC. All juvenile fish at the hatchery are externally marked and coded-wire tagged (CWT) prior to release. Juvenile fish are sampled by the USFWS for mark quality and tag retention prior to release. The tag retention goal at release is a minimum of 95%. |
| **7)** Juvenile releases from Warm Springs NFH survive and return to the hatchery in sufficient numbers to sustain the hatchery program. | The adult production goal from the 750,000 smolts released from Warm Springs NFH is at least 2,250 adults returning to the mouth of the Deschutes River. The production goal allows for a harvest in the Deschutes River and a broodstock collection goal of 630 hatchery adults at Warm Springs NFH. | Smolt to adult survival rates are estimated for each brood year. Creel surveys conducted by CTWSRO and ODFW sample fish caught in fisheries in the Deschutes River. A subsample of hatchery spring Chinook salmon returning to the hatchery are biosampled. Coded-wire tag recoveries are used to estimate the age structure of returning fish. |
| **8)** Fully seed available spring Chinook salmon habitat above Warm Springs NFH. | Maintain a minimum escapement goal for wild spring Chinook salmon above Warm Springs NFH of 1,300 adults (60 cm or greater). | Wild spring Chinook salmon abundance is monitored as fish pass through the fish ladder at Warm Springs NFH. The CTWSRO and USFWS will conduct redd surveys in order to estimate spawning abundance. |

| **Benefits**<br>**Performance Standards** | **Performance Indicators** | **Monitoring and Evaluation** |
|---|---|---|
| **9)** Maintain the genetic characteristics and stock integrity of wild summer steelhead in the Warm Springs River above Warm Springs NFH. | Intentionally pass only wild (unmarked) steelhead above the barrier dam at Warm Springs NFH. | During the steelhead migration period all fish are sorted by hand. All hatchery steelhead, identified as having missing or deformed fins, are killed at the hatchery and distributed to the CTWSRO. All wild steelhead are passed upstream. The disposition of each fish handled is recorded in fish removal database files maintained by the USFWS Columbia River Fisheries Program Office. |
| **10)** Maintain the genetic characteristics and stock integrity of indigenous fish populations in the Warm Springs River. | Only known indigenous fish species will be intentionally passed above the barrier dam at Warm Springs NFH. | Fish passed upstream are monitored either manually or through a video-monitor system. |
| **11)** Warm Springs NFH enhances stream enrichment opportunities in the Warm Springs River. | Carcasses from hatchery broodstock are available for outplanting into the Warm Springs River after spawning. | All carcasses are screened by the fish health center for disease prior to being outplanted into the stream. Carcasses are treated (by evisceration and heat-baking) to prevent potential disease transmission. |
| **12)** Design and implement projects to improve the quality of fish production at Warm Springs NFH. | Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations. | Monitoring programs will be incorporated into project designs. Examples of project designs include diet studies, rearing density studies, and rearing environment projects. |
| **13)** Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin. | A yearly meeting with all cooperators and policy level personnel will be held annually in March. Quarterly meetings with the hatchery evaluation team will include hatchery, management, fish health, and tribal representatives. | Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin. |

| **Risks**<br>**Performance Standards** | **Performance Indicators** | **Monitoring and Evaluation** |
|---|---|---|
| **1)** Hatchery operations comply with ESA responsibilities. | Hatchery conducts Section 7 consultations and completes an HGMP. Section 10 permits are issued when applicable. | Refer to M&E Section in this document. |
| **2)** Hatchery operations comply with water quality standards. | Hatchery meets the requirements of the National Pollution Discharge Elimination Permit. | Environmental monitoring of total suspended solids, settleable solids, in-hatchery water temperatures, in hatchery dissolved oxygen, nitrogen, ammonia, and pH is conducted annually at the hatchery. |
| **3)** Handling of wild spring Chinook salmon is minimized. | An automated fish passage system is used that passively separates coded-wire tagged hatchery spring Chinook from wild fish. The minimum operating standards for the system are removal of 95% of the fish with coded-wire tags and 95% accuracy in counting upstream-bound fish. | Trapping efficiency is evaluated on a regular basis. During efficiency testing upstream bound fish will be held overnight and then manually examined for fin clips and the presence of coded-wire tags. Video monitoring is used to estimate wild fish passage above the hatchery. |
| **4)** Harvest of hatchery produced fish minimizes impacts to wild fish populations. | Number of non-target or wild fish caught in tribal and non-tribal fisheries. | The CTWSRO and USFWS formulate a pre-season run prediction for Warm Springs River stocks returning to the Deschutes River. The CTWSRO and ODFW co-manage and monitor the fishery in order to ensure that impacts to wild fish are minimized. |
| **5)** Juvenile hatchery releases minimize interactions with wild fish species. | a) All juvenile releases will be at Warm Springs NFH except to meet CTWSRO requests.<br>b) Juvenile releases do not negatively impact wild populations in the Warm Springs River and Deschutes River. | A juvenile trap located downstream of Warm Springs NFH monitors the outmigration of hatchery and wild fish. Juvenile releases may also be monitored using radio telemetry, PIT tagging, snorkeling, trapping, or other techniques. |
| **6)** Straying of hatchery fish is minimized. | Recovery of Warm Springs NFH produced fish in non-target watersheds. Stray hatchery steelhead are collected at Warm Springs NFH (see Benefit 9). | Coded-wire tag recoveries throughout the Columbia basin are recorded and summarized in order to estimate the amount of straying of Warm Springs NFH spring Chinook salmon. |
| **7)** The water intake system minimizes impacts to wild fish populations. | Water intake screens are replaced in order to meet NMFS Hatchery Biological Opinion criteria. | Screens are monitored by hatchery personnel on a regular basis. |

| Risks<br>Performance Standards | Performance Indicators | Monitoring and Evaluation |
|---|---|---|
| **8)** Minimize disease risk to wild fish. | Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy. The USFWS wild fish health survey protocols are followed. | Juvenile fish health is monitored on at least a monthly basis at the hatchery in order to detect potential disease problems. A fish health specialist will examine affected fish and make recommendations on remedial or preventative measures. Therapeutic and prophylactic treatments will be administered upon consultation with the fish health specialist and in accordance with USFWS and the Integrated Hatchery Operation Team's policies. Wild fish used in the broodstock are checked for disease. Wild fish juveniles in the stream are periodically checked, as identified in the hatchery operations plan. |

## 1.11) Expected size of program.

### 1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The annual broodstock collection goal is a maximum of 630 adult spring Chinook salmon. The goal is to have, on a 10 year average, 10% of the hatchery broodstock be of wild fish origin.

### 1.11.2) Proposed annual fish release levels (maximum number) by life stage and location

| Life Stage | Release Location | Annual Release Level |
|---|---|---|
| **Eyed Eggs** | - | - |
| **Unfed Fry** | - | - |
| **Fry** | - | - |
| **Fingerling** | Fall volitional release at Warm Springs NFH | 75,000[A] |
| **Yearling** | On site release at Warm Springs NFH | 750,000 |
| **Adult** | Adult outplanting into Shitike Creek | 200 |

[A]Fall volitional release is estimated to be 10% of the total number of fish in the ponds. The 10% estimate is based on smolt trap estimates made during the first year of the volitional release program as well as by estimates from the hatchery on pond density and feed use. Additional mark–recapture techniques are being investigated.

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

Table 1.12a. Comparison of survival at different life stages for wild and hatchery spring Chinook salmon from the Warm Springs River, 1985-1996 broodyears (Olson and Spateholts 2001).

| | Hatchery Stock | | | Wild Stock | | |
|---|---|---|---|---|---|---|
| **Brood Year** | **Egg to Juvenile (%)** | **Juvenile to Adult (%)** | **Recruit per Spawner** | **Egg to Juvenile (%)** | **Juvenile to Adult (%)** | **Recruit per Spawner** |
| 1985 | 55.33 | .54 | 4.53 | 7.31 | 3.01 | 3.49 |
| 1986 | 87.14 | .28 | 3.2 | 8.27 | 3.19 | 3.57 |
| 1987 | 84.1 | .13 | 1.2 | 7.47 | 1.46 | 1.47 |
| 1988 | 86.94 | .18 | 1.79 | 9.88 | 1.78 | 2.65 |
| 1989 | 92.93 | .02 | .21 | 7.59 | .69 | .82 |
| 1990 | 68.94 | .005 | .04 | 7.29 | .40 | .52 |
| 1991 | 81.54 | .02 | .22 | 5.4 | .37 | .28 |
| 1992 | 88.95 | .16 | 1.58 | 13.66 | 2.57 | 4.11 |
| 1993 | 98.46 | .29 | 4.1 | 8.76 | 2.68 | 3.55 |
| 1994 | 85.71 | .15 | 1.94 | 13.79 | .46 | .99 |
| 1995 | 83.51 | .43 | 7.3 | 2.24 | 12.95 | 4.54 |
| 1996 | 93.45 | 1.27 | 14.35 | 18.48 | 2.27 | 6.09 |
| **Mean** | 83.92 | .29 | 3.37 | 9.18 | 2.65 | 2.67 |

Table 1.12b. Number of wild and hatchery spring Chinook salmon passed upstream of or held at Warm Springs NFH. Wild fish to the hatchery includes mortalities and fish used for broodstock; hatchery fish to the hatchery includes fish used for broodstock and surplus fish (CRiS Database 3/18/02).

| Year | Wild Spring Chinook Upstream | Wild Spring Chinook to Hatchery | Hatchery Spring Chinook Upstream | Hatchery Spring Chinook to Hatchery |
|---|---|---|---|---|
| 1990 | 1767 | 5 | 0 | 1390 |
| 1991 | 816 | 1 | 0 | 634 |
| 1992 | 973 | 89 | 0 | 766 |
| 1993 | 534 | 4 | 0 | 308 |
| 1994 | 435 | 0 | 0 | 62 |
| 1995 | 235 | 2 | 0 | 289 |
| 1996 | 1245 | 42 | 0 | 734 |
| 1997 | 867 | 3 | 113 | 922 |
| 1998 | 271 | 0 | 21 | 624 |
| 1999 | 492 | 2 | 32 | 2676 |
| 2000 | 2630 | 73 | 285 | 6300 |
| 2001 | 2193 | 59 | 303 | 4163 |

The number of wild spring Chinook held at Warm Springs NFH for broodstock is based on a sliding scale of the total expected return (see Section 6.2.3). The number of hatchery fish passed above the hatchery is not to exceed 10% of the wild run.

**1.13) Date program started (years in operation), or is expected to start.**

Full production at Warm Springs NFH began in 1978.

**1.14) Expected duration of program.**

The program is ongoing.

**1.15) Watersheds targeted by program.**

Warms Springs River, Shitike Creek, and Deschutes River subbasins.

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

Alternative actions include:

1.) Using only hatchery spring Chinook salmon for broodstock needs.
2.) Using only wild spring Chinook salmon for broodstock needs.
3.) Allowing all hatchery fish in excess of broodstock needs to be passed upstream of Warm Springs NFH.
4.) Discontinuing hatchery production of spring Chinook salmon.

None of the alternative actions considered would meet the program goal of providing a sustainable harvest of spring Chinook salmon while maintaining the biological and genetic characteristics of spring Chinook salmon populations in both the hatchery and stream environments.

## SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

**2.1) List all ESA permits or authorizations in hand for the hatchery program.**

NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin 1999.

**2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

Steelhead (*Oncorhynchus mykiss*), Mid-Columbia ESU, Threatened

**2.2.1) Description of ESA-listed salmonid population(s) affected by the program.**

**Identify the ESA-listed population(s) that will be directly affected by the program.**

The Warm Springs NFH spring Chinook salmon program uses hatchery and wild Warm Springs River spring Chinook salmon in its broodstock program. Warm Springs River spring Chinook salmon are not listed as a threatened or endangered species at this time. No listed species are expected to be directly affected by the spring Chinook salmon program.

**Identify the ESA-listed population(s) that may be incidentally affected by the program.**

Listed populations that may be incidentally affected by the spring Chinook salmon program include species utilizing habitat in the Warm Springs River, Shitike Creek, Deschutes River, and the Columbia River downstream of the confluence of the Deschutes River. Of particular concern to the Warm Springs NFH is the population of threatened summer steelhead (*Oncorhynchus mykiss*). Summer steelhead in the Warm Springs River and the Deschutes River subbasin, a component of the Middle Columbia River Evolutionary Significant Unit, were listed as a threatened species by the National Marine Fisheries Service in 1999. The life history characteristics of Warm Springs River summer steelhead are typical of Middle Columbia steelhead. Adult steelhead migrate from the ocean, up the Columbia River, and begin entering the Deschutes River in June. Most adults destined to spawn in the Warm Springs River overwinter in the mainstem of the Deschutes River and begin their spawning migration by entering the Warm Springs River in mid-February. The peak migration past Warm Springs NFH typically occurs in mid-April and is completed by late May (CRiS Database 7/11/02.). Steelhead may begin spawning soon after they enter the Warm Springs River, with spawning taking place from late February to early June. Spawning in the Warm Springs River subbasin primarily occurs in the upper sections of the river above Warm Springs NFH, and in tributaries such as Mill Creek, Beaver Creek, and Badger Creek (Cates 1992).

Depending on the time of spawning and water temperatures, fry emerge from the gravel in spring or early summer. Juvenile steelhead in the Warm Springs River exhibit two life history strategies. Some juvenile steelhead rear in the Warm Springs River for one to three years until they begin the smolting process and migrate to the ocean. Another component of the juvenile population migrates out of the Warm Springs River as presmolts and continues to rear in the Deschutes River for one to three years before smolting and migrating to the ocean. The outmigration of juvenile steelhead from the Warm Springs River occurs during the higher spring flows, typically from March through June. A smaller outmigration of primarily presmolt juvenile steelhead occurs in the fall (Cates 1992).

Shitike Creek, a tributary of the Deschutes River located on the Warm Springs Reservation, also supports a population of summer steelhead. The life history characteristics of steelhead in Shitike Creek are thought to be similar to those in the Warms Springs River, with adult steelhead entering Shitike Creek in the early spring and spawning taking place shortly after entrance into the creek. The primary spawning area in Shitike Creek is thought to be below Peters Pasture (RM 25). Juvenile steelhead rear in the lower sections of the creek or emigrate to the Deschutes River for rearing. The CTWSRO operates an adult weir and a rotary screw trap near the mouth of Shitike Creek in order to gather life history information on steelhead, bull trout, and spring Chinook salmon. Steelhead redd surveys are also conducted by CTWSRO staff in late April or early May.

### 2.2.2) Status of ESA-listed population(s) affected by the program.

Table 2.2. Number of adult summer steelhead counted at the fish ladder at Warm Springs NFH by run year. Hatchery steelhead (missing or deformed fins) are considered to be strays and are killed at the hatchery (CRiS Database 3/18/02).

| Year | Summer Steelhead | | |
|---|---|---|---|
| | Wild | Stray Hatchery | Total |
| 1989 | 385 | 204 | 589 |
| 1990 | 339 | 182 | 521 |
| 1991 | 165 | 129 | 294 |
| 1992 | 280 | 403 | 683 |
| 1993 | 79 | 109 | 188 |
| 1994 | 135 | 147 | 282 |
| 1995 | 95 | 101 | 196 |
| 1996 | 85 | 173 | 258 |
| 1997 | 243 | 349 | 592 |
| 1998 | 214 | 380 | 594 |
| 1999 | 96 | 80 | 176 |
| 2000 | 319 | 417 | 736 |
| 2001 | 503 | 319 | 822 |

### 2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take

Incidental take of summer steelhead could occur through activities associated with the Warm Springs NFH adult collection facility. A fish barrier dam, adjacent to the hatchery, blocks upstream passage of all fish and directs them into a fish ladder located at the hatchery. Upon entering the fish ladder, fish are either directed into holding ponds or passed upstream above the barrier dam. An automated fish passage system is used during the spring Chinook salmon migration period, generally from May through the end of September. The automated passage system is designed to minimize handling of wild fish by passively separating returning hatchery spring Chinook salmon, identified by the presence of coded-wire tags, from wild fish. The passage system uses a 15-foot long denil steeppass fishway with a coded-wire tag tube detector and gate. As fish swim through the fishway and tube detector, coded-wire tagged fish are detected and a gate

opens that shunts them into a holding pond. Non coded-wire tagged fish do not trigger the gate and are able to continue migrating up through the fish ladder and upstream of the barrier dam. A video system records non-coded wire tagged fish as they pass upstream of the hatchery. The video system allows hatchery personnel to monitor the number, species, and origin of fish passing upstream. During operation of the automated passage system wild fish are not handled by hatchery personnel, thereby reducing the potential take of listed species. Migration delays as fish find their way into the fish ladder and through the passage system, rejection of the fish ladder resulting in displaced spawning, and injuries suffered as adults try to jump the barrier dam are potential incidental takes associated with the barrier dam. The actual level of incidental take associated with the barrier dam is unknown at this time. Based on observations by hatchery personnel of fish movements through the barrier dam and passage system, the level of take is assumed to be low (Mike Paiya, USFWS Warm Springs NFH, pers. comm..).

The automated passage system is only used during the spring Chinook salmon migration period, generally from April 15 to September 30. The proper functioning of the passage system relies on 100% coded-wire tagging of hatchery fish, with all non coded-wire tagged fish passed upstream. All spring Chinook salmon juveniles released from Warm Springs NFH are coded-wire tagged (the tag retention goal is 95%) but stray hatchery fish from hatcheries outside the subbasin may not be coded-wire tagged. The Warm Springs River, and the Deschutes River subbasin in general, has a high incidence of stray hatchery steelhead (Olson and Pastor 1998). In order to preserve the genetic integrity of wild steelhead in the Warm Springs River, it is the policy of Warm Springs NFH to pass only wild (unmarked) steelhead above the barrier dam. In order to accomplish this goal, the automated fish passage system is not used until the steelhead migration has ended, usually sometime in late April. During the steelhead migration period fish find their way into the fish ladder and into a holding pond. Hatchery personnel then hand sort the fish. Fish are sedated using $CO_2$, sorted, measured, and then either passed upstream or collected for the hatchery. All wild summer steelhead, bull trout, and other indigenous fish species are passed upstream. Stray hatchery steelhead, identified as having missing or deformed fins, are held in holding ponds, killed, and distributed to the CTWSRO.

Incidental take of listed species may occur during the manual sorting of fish in the fish ladder at Warm Springs NFH. Potential take could occur as a result of delay in migration timing, stress associated with handling, or misidentification of wild and hatchery steelhead. Hatchery personnel attempt to minimize handling stress on fish by following the appropriate fish handling guidelines. Direct take on listed species as a result of the fish barrier dam, fish ladder, and hatchery sorting procedures has been minimal. Three unmarked adult steelhead were accidentally killed in 1998. No other mortality of unmarked adult steelhead at the hatchery has been recorded since 1995 (CRiS Database 3/18/02).

Monitoring activities associated with the Warm Springs spring Chinook program also have the potential for incidental take of listed steelhead and bull trout. A rotary screw trap, located at approximately Rkm 5 of the Warm Springs River, is operated by the CTWSRO in order to gather outmigration timing and population estimates for juvenile

spring Chinook salmon. The trap is typically operated from mid-March through mid-November. Juvenile spring Chinook salmon collected at the trap are anesthetized with MS-222, measured, weighed, and a subsample is marked and released upstream for mark-recapture population estimates. Some juvenile spring Chinook salmon may be implanted with radio-tags in order to monitor their migration behavior in the Deschutes River (See Section 12). Listed juvenile steelhead and bull trout are also collected at the trap. Juvenile steelhead and juvenile resident trout are visually indistinguishable and are summarized together for monitoring purposes. Juvenile steelhead will be handled, measured, and marked using the same procedures as for spring Chinook salmon. For an estimate of the number of steelhead trapped see Take Table 1. The probability of capture for juvenile bull trout in the trap is low, with fewer than ten bull trout trapped per year (Bob Spateholts, CTWSRO Warm Springs, pers. comm). If juvenile bull trout are collected at the trap they will be weighed, measured, marked, and released upstream.

Incidental take of juvenile summer steelhead may occur through stress associated with the handling and marking procedures. Procedures associated with the juvenile trap are designed to minimize stress and potential take. The traps are checked regularly in order to minimize the amount of time fish are held at the trap. The amount of time fish are under anesthetic is carefully monitored and fish are allowed sufficient time to recover before being released back into the river. The potential for direct take of listed species at the traps as a result of trap malfunction or predator intrusion is considered to be low. The CTWSRO have observed mink predation on fish caught in the screw trap (Bob Spateholts, CTWSRO Warm Springs, pers. comm.). If recurring predators become a problem, live traps may be set to relocate the predators away from the trap site. During periods of high flows debris may clog the rotary screw mechanism or live box, possibly resulting in descaling or wounding of fish in the trap. Daily monitoring of the trap is expected to minimize take associated with trap malfunction or predator intrusion. If high flows are anticipated, the trap is raised in order to reduce the likelihood of trap malfunction. The traps are also deactivated when water temperatures exceed 20 degrees Celsius or if there are visible signs of stress in fish in the live box. Estimated take levels for listed steelhead in the Warm Springs River are summarized in Take Table 1.

The USFWS expects to conduct research and monitoring activities at the hatchery and in the stream environment that will focus on the ecological interactions of hatchery and wild fish in the Warm Springs River, Shitike Creek, and Deschutes River. The research program is intended to gather information that will help managers evaluate hatchery practices and reduce impacts of the hatchery program on wild fish populations. Proposed research activities associated with Warm Spring NFH are discussed in detail in Section 12. Sampling of spring Chinook salmon will occur through the normal hatchery and monitoring activities on the Warm Springs River. Incidental take associated with the research program is expected to be minimal. Up to 100 juvenile spring Chinook salmon will be implanted with radio-tags at the rotary screw trap on the Warm Springs River. Other research activities on the Warm Springs River include expanded redd surveys and tissue sampling for genetic pedigree analysis of hatchery spring Chinook salmon at the Warm Springs NFH.

The USFWS and the CTWSRO also anticipate conducting monitoring and research activities on Shitike Creek. Shitike Creek is small tributary of the Deschutes River that is located on the Warm Springs Reservation. Since 2000, the USFWS and the CTWSRO have outplanted Warm Springs NFH adult spring Chinook salmon into Shitike Creek. The objectives of the monitoring and research program are as follows:

1) Evaluate the contribution of outplanted spring Chinook salmon to the natural production in Shitike Creek.
2) Investigate the potential ecological interactions of spring Chinook, bull trout, and summer steelhead in Shitike Creek.

As part of the monitoring program, adult spring Chinook salmon will be sampled at a temporary weir located near the mouth of Shitike Creek. The temporary weir is operated by the CTWSRO as part of a bull trout monitoring program funded by the Bonneville Power Administration. The weir is typically installed in late April or early May, after the main upstream migration of adult summer steelhead. Adult fish migrating upstream are trapped at the weir and sampled by CTWSRO personnel. Sampling includes taking length measurements and scale samples. As part of the spring Chinook salmon program, tissue and scale samples will be collected from all upstream migrating spring Chinook salmon. Incidental take of steelhead may occur at the weir as a result of handling stress or delayed migration, although the weir is typically installed after the steelhead migration (Take Table 2).

Juvenile sampling of downstream migrating fish occurs at a rotary screw trap located near the mouth of Shitike Creek in the town of Warm Springs. The screw trap is operated when flows are sufficient, typically from March through June and from October through November. The CTWSRO operates the trap as part of the bull trout study and also to gather juvenile population estimates for steelhead and spring Chinook. Procedures for operating the Shitike Creek screw trap are the same as for the Warm Springs River screw trap. The outplanting monitoring program will collect tissue samples (fin clips) from approximately 1000 juvenile spring Chinook salmon captured at the trap. Passive Integrated Transponder (PIT) tags may also be applied to juvenile Chinook salmon. No additional take of listed species is anticipated as a result of the spring Chinook salmon sampling. The USFWS and the CTWSRO will also conduct snorkel surveys and juvenile sampling in Shitike Creek during July and August. Snorkel surveys will collect observational data on microhabitat preferences, species associations, and species interactions for juvenile salmonids. Tissue samples from age 0 spring Chinook salmon will be collected during the summer. It is anticipated that age 0 spring Chinook salmon will be collected using either minnow trapping or seining techniques. Minnow traps will be baited with tuna or cat food and placed in selected pools for 45 minutes. The pools will be block-netted at the upstream and downstream ends in order to prevent migration into or emigration out of the pool during sampling. After 45 minutes the traps will be removed and the fish in the traps will be sampled. The fish will then be returned to the stream and the block nets will be removed. If seining is used, snorkelers will enter the stream and “herd” spring Chinook towards a seine, where they will be collected and

sampled. During sampling the fish will be held in containers of freshwater, anesthetized with MS-222, counted, and placed into a recovery bucket. Once the fish have fully recovered they will be released back into the stream. Incidental take may occur as a result of harassment or stress associated the minnow traps or with snorkelers "herding" fish towards a seine. In order to minimize potential take, minnow trapping or seining will not take place in locations where there is a high abundance of listed species.

**- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish**.

Direct injury or mortality due to hatchery operations have historically been low. In 1998, three wild adult steelhead were accidentally killed at the hatchery (CRiS Database 7/11/02).

**-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

See take tables (Take Table 1 for estimated take of listed steelhead in the Warm Springs River, Take Table 2 for estimated take of listed steelhead in Shitike Creek).

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

If take levels exceed the projected levels, the USFWS and the CTWSRO will work with the National Marine Fisheries Service to ensure that hatchery operations minimize future take on the listed species.

## SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

**3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.**

Warm Springs NFH operates in compliance with the ODFW Lower Deschutes River Management Plan, the NPPC Deschutes River Salmon and Steelhead Plan, and the 1999 NMFS Biological Opinion on Columbia River Hatcheries.

**3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates**

This HGMP is consistent with the following agreements, plans, and court orders:

Federal Statute 184
IHOT Standards and Policies
Intra-Service Section 7 Consultation for bull trout
Memorandum of Understanding between the USFWS and the CTWSRO, March 10, 1998
NPPC Deschutes River Salmon and Steelhead Plan
ODFW Lower Deschutes River Management Plan
USFWS and CTWSRO cooperative agreement 2002
U.S. v. Oregon
Wy Kan Ush Me Ka Wit, CRITFC
1999 NMFS Biological Opinion on Columbia River Hatcheries
2002-2006 Hatchery Operation Plan, March 7, 2002

**3.3) Relationship to harvest objectives.**

Artificial production at Warm Springs NFH is integrated with harvest management in order to provide a sustainable harvest of hatchery spring Chinook salmon while minimizing risks to wild fish populations in the Warm Springs and Deschutes Rivers. All juvenile hatchery spring Chinook salmon released from Warm Springs NFH are externally marked for visual identification. The CTWSRO and the Oregon Department of Fish and Wildlife (ODFW) co-manage harvest in the Deschutes River Subbasin, while harvest in the Columbia River is managed by the parties to U.S. v. Oregon. Harvest management decisions are consistent with the ODFW Lower Deschutes River Fish Subbasin Management Plan (1997). Harvest for Warm Springs River spring Chinook salmon occurs primarily in the Deschutes River and lower Warm Springs River. Wild fish abundance drives fishery management decisions made by the CTWSRO and the ODFW.

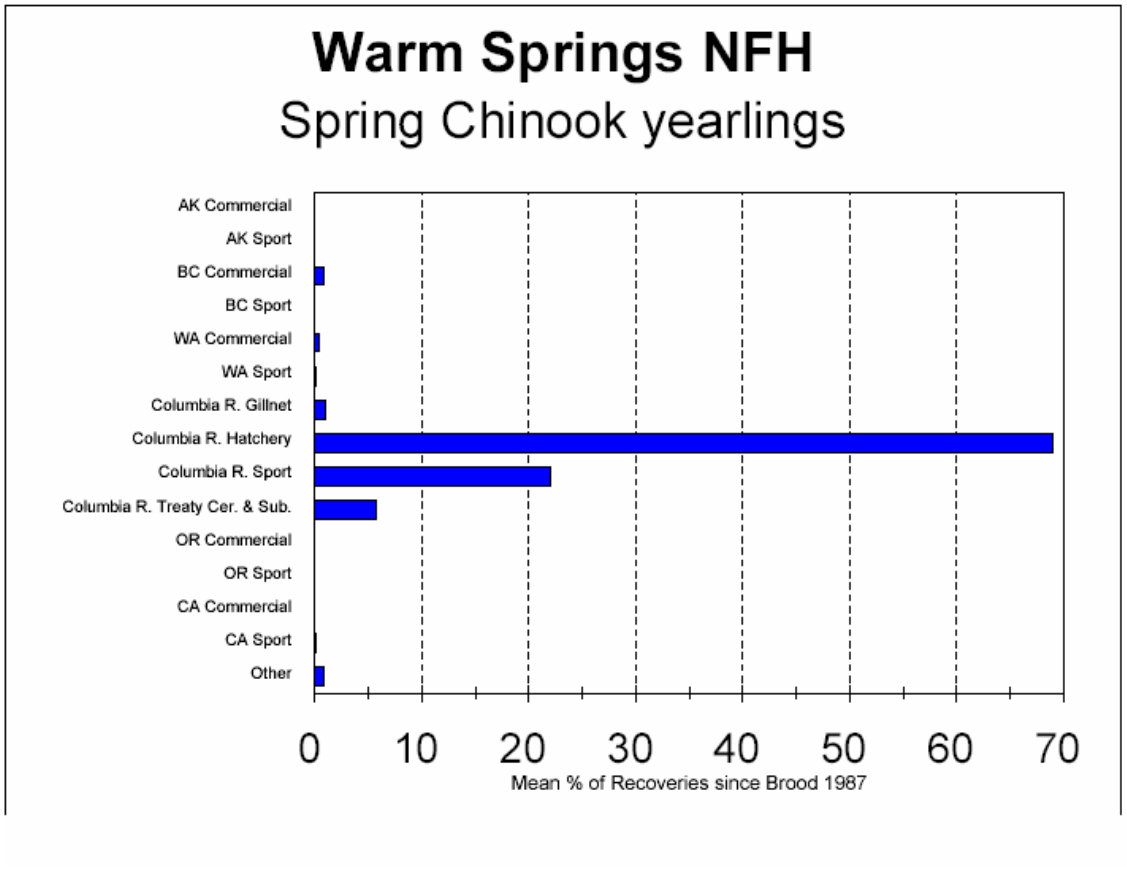
**3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.**

Fisheries benefiting from the Warm Springs NFH spring Chinook program include tribal ceremonial, tribal subsistence, and freshwater sport fisheries. Tribal fisheries also target wild Warm Springs River spring Chinook salmon. The percent contribution by fishery is shown in Graph 3.3.1.

Table 3.3.1. Harvest, total hatchery return, and harvest rate of Warm Springs NFH spring Chinook salmon. Harvest is estimated from coded-wire tag recoveries in tribal and sport fisheries (CRiS Database 7/11/02).

| Brood Year | Harvest | Hatchery Return | Total | Harvest Rate |
|---|---|---|---|---|
| 87 | 376 | 554 | 930 | 40% |
| 88 | 474 | 848 | 1322 | 36% |
| 89 | 70 | 135 | 205 | 34% |
| 90 | 6 | 26 | 32 | 19% |
| 91 | 9 | 85 | 94 | 10% |
| 92 | 137 | 735 | 872 | 16% |
| 93 | 126 | 887 | 1013 | 12% |
| 94 | 15 | 559 | 574 | 3% |
| **Mean** | 152 | 479 | 630 | 24% |

Graph 3.3.1. Coded Wire Tag recoveries for Warm Springs NFH spring Chinook salmon.




## 3.4) Relationship to habitat protection and recovery strategies.

Natural production in the Warm Springs River and Deschutes River is limited by the following: water quantity, water quality, consumptive water use, instream water rights, water diversion screening, sedimentation, stream substrate, cover, and barriers to fish passage (ODFW 1997). The CTWSRO are responsible for habitat protection and recovery strategies on the Warm Springs Reservation. Habitat conditions in the Warm Springs River and Shitike Creek are considered to be fair to good. The CTWSRO have implemented various habitat restoration programs including riparian fencing, water diversion modifications, and placement of instream structures.

**3.5) Ecological interactions.**

1.) Species that could negatively impact the program include the following:

-out of basin stray hatchery summer steelhead,
-stray hatchery spring Chinook salmon,
-northern pikeminnow,
-bull trout
-introduced species such as bass, walleye, and brown trout,
-and avian and mamalian predators.

Negative impacts on the spring Chinook salmon program can occur directly through predation on program fish, or indirectly though competition, genetic mechanisms, or other ecological interactions. Predators such as the northern pikeminnow, bull trout, bass, Caspian tern, and California sea lion may feed on juvenile and adult hatchery salmon in the Columbia River system, reducing the survival rate for program fish. Competition for limited resources from stray hatchery fish could indirectly lead to lower survival rates for program fish.

2.) Fish species that could be negatively impacted by the program include the following:

-listed summer steelhead,
-listed bull trout,
-wild spring Chinook salmon,
-and other species using the Deschutes River subbasin and Columbia River.

Juvenile releases from Warm Springs NFH could have negative impacts on fish species in the Warm Springs, Deschutes, and Columbia rivers. The current production goal is to annually release 750,000 spring Chinook salmon smolts into the Warm Springs River. Warm Springs NFH currently releases juvenile spring Chinook during both a fall and spring release period. Approximately 10% of the hatchery production is volitionally released as sub-yearlings in the fall, from early October to late November. The fall volitional release of age 0+ fish from the hatchery mimics one component of the wild fish juvenile migration pattern from the Warm Springs River. Movement of wild juvenile spring Chinook salmon out of the Warm Springs River is split into a fall and spring

migration period (Lindsay et al. 1989 and Olson et al. 1995). The remaining 90% of hatchery fish are released as yearlings in the spring, from late March through April.

The goal of Warm Springs NFH is to release functional smolts that quickly migrate to the ocean. Most fish released in the spring reach the estuary within three to four weeks (Olson et al. 1995). The behavior of fish released in the fall is not clear. Scale analysis of adult returns indicated that most fall-released fish that survived to adulthood over-wintered in freshwater before migrating to the ocean the following spring (Doug Olson, USFWS Vancouver, pers. comm). A pilot study by the United States Geological Survey (USGS) in 2000 used radio telemetry techniques to investigate the migration behavior of juvenile hatchery spring Chinook salmon released from Warm Springs NFH in the fall. Results of the study showed that 65% of the radio tagged hatchery fish that were released in late October remained in the Deschutes River until the study ended in January. Based on the telemetry data and estimates of the total number of hatchery fish released during the fall period, the USGS estimated that between 19,500 and 48,750 juvenile hatchery spring Chinook from Warm Springs NFH remained in the Deschutes River during the fall of 2000 (Wardell et al. 2002). The USFWS and USGS plan to continue studying the migration behavior of fall-released fish in 2002 (see Section 12).

The impact of the fall release program on the aquatic community in the Warm Springs and Deschutes rivers is not completely understood at this time. The USFWS is developing study designs that will monitor and evaluate the fall release program and investigate potential impacts of the program on fish species in the Deschutes River. The studies are expected to accomplish the following:

1.) Develop a more accurate estimate of the number of fish that are volitionally released from the hatchery in the fall.
2.) Determine the migratory behavior and habitat preference of fall released fish.
3.) Determine whether the Deschutes River can support the fall released fish without adversely impacting the wild fish populations.
4.) Determine whether fall released fish adversely impact the food supply, fish health, competition, or predation in the Deschutes River.

The fall release program is scheduled to continue on a limited basis (approximately 10% of total hatchery production). Fish that are released in the fall, overwinter in the Deschutes River, and survive to spawning may help retain wild fish characteristics in the hatchery program. If, however, the monitoring and evaluation program or related research studies identify potential adverse impacts to wild fish populations, both the USFWS and the CTWSRO will consider modifying the release program in order to minimize these impacts.

Shitike Creek and the Warm Springs River are the only tributaries of the Deschutes River that currently support successful natural spawning of spring Chinook salmon. The density, or redds per mile, of spawning spring Chinook salmon in Shitike Creek has generally been lower than in the Warm Springs River and it is thought that the habitat is

underseeded (Lindsay *et al*. 1989). Habitat improvement and fish passage projects have been ongoing in Shitike Creek since the 1980's. A man made barrier blocking the upper reaches of the drainage was removed in 1983 and a natural cascade was removed to improve adult passage. Despite these improvements natural production in the drainage remained at relatively low levels. Indexed redd counts in Shitike Creek from 1978 to 1999 varied from a low of six in 1996 to a high of 33 in 1997 (CTWSRO unpublished data).

In 2000, the CTWSRO and the USFWS initiated an adult spring Chinook salmon outplanting program designed to increase natural production of spring Chinook in Shitike Creek. Adult hatchery spring Chinook salmon returning to the Warm Springs River are trapped at the Warm Springs NFH and are held in holding ponds at the hatchery until late August or early September. Hatchery personnel then sort the adults for hatchery broodstock collection, with some surplus hatchery fish selected for outplanting into Shitike Creek. Outplanted fish are released at various locations within Shitike Creek during early September and are allowed to spawn naturally. The goal of the program is to annually release approximately 200 adult spring Chinook at up to five locations within Shitike Creek. The number of fish released and the locations of release were based on the estimated amount of suitable spawning habitat in selected stream reaches. In 2000, the first year of spring Chinook outplanting, 110 males and 49 females were released into Shitike Creek. Spawning ground surveys for 2000 counted 52 spring Chinook redds, the highest number of redds counted since surveys began in 1978 (CTWSRO unpublished data). The USFWS is conducting a radio telemetry study and a genetic analysis of outplanted spring Chinook salmon in Shitike Creek in order to estimate the spawning success and spawning site selection of outplanted fish (see Section 12).

Most of the natural production of spring Chinook salmon in Shitike Creek during the past 20-30 years has occurred in the lower 10 miles of the stream. Bull trout are thought to spawn and rear in the upper sections of Shitike Creek while summer steelhead spawn and rear in the middle and lower sections (Bob Spateholts, CTWSRO Warm Springs, pers. comm) The outplanting program is expected to increase the natural production of spring Chinook salmon in Shitike Creek by increasing the adult spawning population. While the current level of interspecific competition between Chinook, steelhead, and bull trout in Shitike Creek is not known, the potential for competition would be expected to increase as spring Chinook salmon populations increase and habitat utilization increases. Juvenile spring Chinook salmon may provide a forage base for bull trout and other species in Shitike Creek. If other types of interspecific competition, such as overlap in microhabitat use or antagonistic behavior, exist the outplanting program may have unintended negative impacts on these species. Conversely, differences in microhabitat use by juveniles of different species may indicate a mechanism by which competing species are able to coexist in the same macrohabitat, thereby minimizing potential negative consequences of the outplanting program.

The microhabitat preferences and level of interaction between juvenile spring Chinook salmon and juvenile steelhead in areas of co-occurrence in Shitike Creek is not known. Summer steelhead are thought to inhabit the middle and lower sections of Shitike Creek,

areas where relatively high densities of juvenile spring Chinook salmon are found. The USFWS and the CTWSRO anticipate initiating monitoring and evaluation activities that will look at potential impacts of the outplanting program on indigenous fish species in Shitike Creek.

3.) Fish species that could positively impact the program include wild spring Chinook salmon and other salmonid species that naturally spawn in the Warm Springs and Deschutes rivers. Wild spring Chinook salmon are the source of approximately 10% of the broodstock at Warm Springs NFH. Decaying carcasses of salmonid species may contribute nutrients that increase productivity in the subbasin. Warm Springs NFH, in cooperation with the CTWSRO, distributes the carcasses of hatchery broodstock fish throughout the Warm Spring River in order to increase the nutrient supply. Prior to distribution in the river, carcasses are beheaded and eviscerated to prevent transmission of fish pathogens.

4.) Fish species that could be positively impacted by the program include the following:

-listed summer steelhead,
-listed bull trout,
-other species using the Deschutes River subbasin and Columbia River.

Freshwater and marine species that depend on salmonids as a nutrient and food base could be positively impacted by the program. Many species are known to utilize juvenile and adult salmon as a nutrient food base (Groot and Margolis 1991; McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Declines in wild salmonid populations during the last few decades could reduce overall ecosystem productivity. Hatchery production has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climactic cycles.

## SECTION 4. WATER SOURCE

**4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.**

The water source for the hatchery is the Warm Springs River. All water rights on the Warm Springs River are the property of the CTWSRO. The intake structure and pumps are located at the hatchery site just upstream of the barrier dam. Prior to being pumped, water is passed through a trash rack and traveling screen. In front of the traveling screen is a fish bypass which deposits small fish below the barrier dam. The screens on the intake are 3/16th inch mesh.

**4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

A small number of wild juvenile steelhead or resident rainbow trout, lamprey, and suckers has been observed in the rearing ponds at the hatchery. This indicates that juvenile fish from the Warm Springs River are making it through the intake and into the hatchery. The Integrated Hatchery Operations Team noted that the current 3/16th inch mesh does not meet the 1/10th inch standard for screening facilities (IHOT 1996). The Warm Springs NFH Implementation Plan (CTWSRO and USFWS 2002) identifies the need to replace the water intake structure to meet NMFS Hatchery Biological Opinion criteria.

## SECTION 5. FACILITIES

**5.1) Broodstock collection facilities (or methods)**.

All fish passing upstream are blocked by a barrier dam and are directed to a fish ladder at Warm Springs NFH. All fish must use the fish ladder in order to pass upstream of the hatchery. During the spring Chinook salmon migration period (April 16- September 30), an automated fish passage system is used to pass all wild (unmarked) fish upstream of the barrier dam (see Section 2.2.3 for more details). Fish that are not passed upstream are directed into a catch pond. The catch pond measures 28ft x 8ft, with a water depth of 3ft. Fish are then moved from the catch ponds into holding ponds at the hatchery. Fish are held in the holding ponds until spawning.

**5.2) Fish transportation equipment (description of pen, tank truck, or container used).**

Approximately 200 hatchery adult spring Chinook salmon are outplanted into Shitike Creek during late August and early September. Staff from the CTWSRO use a tank truck to transport fish from the adult holding ponds to five release sites along Shitike Creek.

**Egg Transportation**

There is no off-station transport of spring Chinook salmon eggs at the present time.

**Fingerling Transportation**

There is no off-station transport of spring Chinook salmon fingerlings at the present time.

**Smolt Transportation**

There is no off-station transport of spring Chinook salmon smolts occurring at the present time.

There has been transport of eggs, fingerlings, and smolts to other sites for research purposes by USGS in the past. Emergency conditions at the hatchery may result in the temporary transfer of eggs or juveniles to other hatcheries (see Section 5.7).

**5.3) Broodstock holding and spawning facilities.**

Two oval shaped ponds, each 50ft x 26ft with approximately a 6ft water depth are used to hold broodstock until spawning. Each pond is fully enclosed at the top and sides above the water surface by nylon netting. The netting prevents fish from jumping out of the holding ponds and prevents predators from gaining entry. The ponds are plumbed to supply chilled water as summer water temperatures increase.

**5.4) Incubation facilities**.

Incubation facilities consist of 16 stacks of 15 Heath incubator trays.

**5.5) Rearing facilities.**

Rearing facilities at Warm Springs NFH consist of 20 rectangular Burrows ponds measuring 75ft x 16ft with a water depth of 1.7ft, and 20 modified rectangular Burrows ponds measuring 75ft x 8ft with a water depth of 1.7ft.

**5.6) Acclimation/release facilities.**

All Warm Springs NFH spring Chinook salmon smolts are released onsite at the hatchery. Gates are opened at the end of each raceway that allow fish to leave the hatchery via a pipe that enters the Warm Springs River, just downstream of the adult barrier dam.

**5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

In March of 1999, a traffic accident on Highway 26 resulted in a spill of diesel fuel into Beaver Creek, a tributary to the Warm Springs River above Warm Springs NFH. Due to concerns about fuel entering the water supply at the hatchery, all of the brood year 1998's smolts were released early. On 4 March approximately 775,000 smolts were released from the hatchery and into the Warm Springs River, this release was approximately four to six weeks earlier than the normal release time at Warm Springs NFH. No direct mortality from the early release was observed. In addition to the early release of BY 1998 smolts, BY 1999 juveniles were transported to Round Butte Hatchery. Round Butte Hatchery is located on the Deschutes River at the base of Round Butte Dam (RM 110), and is operated by the Oregon Department of Fish and Wildlife. Round Butte Hatchery and its satellite (Pelton Ladder) are used for adult collection, egg incubation, and rearing of spring Chinook salmon and summer steelhead. Round Butte Hatchery temporarily held the BY 1999 juveniles until the water supply at WSNFH was tested and found to be safe.

**5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

Warm Springs NFH is equipped with backup generators and pumps that provide power in case of power failures. An automated alarm system alerts on-call staff members of potential problems at the hatchery during non-work hours. The hatchery also has a chemical spill kit and floating booms to contain accidental spills. In extreme situations, fish at WSNFH can be transported to Round Butte hatchery for temporary holding (see Section 5.7).

The LCRFHC manages fish health and disease prevention in accordance with the USFWS Fish Health and IHOT policies and with protocols of ODFW. Any health problems are managed promptly by fish health personnel to limit mortality and reduce disease transmission.

## SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

**6.1) Source**.

-Wild Warm Springs River spring Chinook salmon (unlisted)
-Warm Springs NFH spring Chinook salmon
-Round Butte Hatchery spring Chinook salmon (potential use during years of low returns to Warm Springs hatchery).

Round Butte Hatchery spring Chinook salmon are thought to have similar life history characteristics to Warm Springs NFH spring Chinook salmon (Doug Olson, USFWS Vancouver, pers. comm). The original broodstock for Round Butte Hatchery was collected from a trap at Sherars Falls in the lower Deschutes River. It is likely that most fish collected at the falls were Warm Springs River spring Chinook salmon since the Warm Springs River is the major producer of spring Chinook salmon in the Deschutes River subbasin.

**6.2) Supporting information**.

**6.2.1) History.**

During the first four years of broodstock collection (1978-1981), 100% of the broodstock was collected from wild Warm Springs River spring Chinook salmon. Since 1981, the majority of broodstock has been of Warm Springs NFH origin. In order to maintain wild

characteristics in the hatchery program, the Warm Springs NFH Operation and Implementation Plan 2002-2006 sets a goal of having an average of 10% of the hatchery broodstock of wild origin, based on a sliding scale according to total wild returns (see Section 6.2.3).

**6.2.2) Annual size.**

The broodstock collection goal is 630 adult spring Chinook salmon.

**6.2.3) Past and proposed level of natural fish in broodstock**.

Since 1990, the number of wild fish incorporated into the broodstock has ranged from 0 to 59 (see table 7.4.2). The current goal of the hatchery program is to have, on a 10 year average, 10% of the hatchery broodstock of wild fish origin. A sliding scale for wild broodstock retention based on projected wild fish returns will be used.

Table 6.2.3. Sliding scale for using wild spring Chinook salmon in the hatchery broodstock (CTWSRO and USFWS 2002).

| Projected Wild Escapement | Wild fish retained for Warm Springs NFH brood | Percent of hatchery brood contributed by wild fish |
|---|---|---|
| <800 | 0 | 0 |
| 800-899 | 31 | 5 |
| 900-999 | 38 | 6 |
| 1000-1099 | 45 | 7 |
| 1100-1199 | 50 | 8 |
| 1200-1299 | 57 | 9 |
| 1300-1399 | 63 | 10 |
| 1400-1499 | 69 | 11 |
| 1500-1599 | 76 | 12 |
| 1600-1699 | 82 | 13 |
| 1700-1799 | 88 | 14 |
| 1800-1899 | 95 | 15 |
| 1900-1999 | 100 | 16 |
| 2000-2099 | 107 | 17 |
| 2100-2199 | 113 | 18 |
| 2200-2299 | 120 | 19 |
| >2300 | 126 | 20 |

**6.2.4) Genetic or ecological differences**.

The goal of the Warm Springs NFH spring Chinook salmon program has been to integrate wild and hatchery fish in a way that maintains the biological and genetic characteristics of the fish populations in both the hatchery and stream environments. Monitoring and evaluation of the program has been ongoing since its inception in 1978. Recent evaluation studies indicate that while measurable differences have been detected in some life history characteristics, the hatchery population closely mimics those of the wild population (Olson and Spateholts 2001).

**6.2.5) Reasons for choosing.**

Wild Warm Springs River spring Chinook salmon are adapted to the physical and biological characteristics of the Warm Springs River.

**6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

No adverse genetic effects to listed summer steelhead or bull trout are expected from the spring Chinook salmon hatchery broodstock selection process.

## SECTION 7. BROODSTOCK COLLECTION

**7.1) Life-history stage to be collected (adults, eggs, or juveniles)**.

Warm Springs NFH collects adult spring Chinook salmon for broodstock.

**7.2) Collection or sampling design.**

All fish passing upstream are blocked by a barrier dam and are directed to a fish ladder at Warm Springs NFH. During the spring Chinook salmon migration period (April 15-September 30), an automated fish passage system is used to pass all wild, unmarked fish upstream of the barrier (see Section 2.2.3 for more details). All coded-wire tagged fish are shunted into holding ponds. Adult fish are selected for broodstock proportionately throughout the run based on wild stock run timing. The target for broodstock collection is presented on the following page.

Table 7.2. Broodstock collection targets for Warm Springs NFH (CTWSRO and USFWS 2002).

| Date | Cumulative Percent of Brood Collected |
|---|---|
| May 8 | 12 |
| May 15 | 24 |
| May 23 | 45 |
| May 31 | 67 |
| June 8 | 77 |
| June 15 | 86 |
| June 23 | 89 |
| June 30 | 91 |
| July 31 | 93 |
| Aug 25 | 100 |

## 7.3) Identity.

All juvenile Warm Springs NFH spring Chinook salmon are adipose-fin clipped and coded-wire tagged prior to release**.** The USFWS samples juvenile fish for mark quality and tag retention prior to release. The program goal is a minimum tag retention rate of 95%. The automated fish passage system sorts returning hatchery and wild fish based on the presence of coded-wire tags.

## 7.4) Proposed number to be collected:

### 7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The Warm Springs NFH Operation and Implementation Plan 2002-2006 sets a broodstock goal of 630 spring Chinook salmon, assuming 90% pre-spawning survival and a return that is 60% female. When the number of returning males is low, the male to female spawning ratio will be 1:2. Fish that are 60 cm in length or longer are considered adults. Between two and five percent of the broodstock will be composed of jacks, i.e. fish less than 60 cm in length. The percentage reflects the estimated contribution of jacks to the wild spawning population.

**7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:**

Table 7.4.2. Number of hatchery and wild spring Chinook salmon spawned at Warm Springs NFH (CRiS Database 3/18/02).

| | Hatchery | | | Wild | | |
|---|---|---|---|---|---|---|
| **Year** | **Females** | **Males** | **Jacks** | **Females** | **Males** | **Jacks** |
| 1990 | 448 | 289 | 0 | 0 | 0 | 0 |
| 1991 | 272 | 197 | 0 | 0 | 0 | 0 |
| 1992 | 294 | 197 | 21 | 28 | 31 | 1 |
| 1993 | 161 | 117 | 2 | 0 | 0 | 0 |
| 1994 | 28 | 20 | 3 | 0 | 0 | 0 |
| 1995 | 48 | 43 | 15 | 0 | 0 | 0 |
| 1996 | 364 | 272 | 0 | 16 | 10 | 0 |
| 1997 | 296 | 200 | 3 | 0 | 0 | 0 |
| 1998 | 355 | 177 | 44 | 0 | 0 | 0 |
| 1999 | 393 | 180 | 39 | 0 | 0 | 0 |
| 2000 | 279 | 164 | 7 | 29 | 25 | 1 |
| 2001 | 246 | 185 | 15 | 19 | 24 | 0 |

**7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

Surplus hatchery fish are used to meet the needs of the CTWSRO. Since 2000, approximately 200 adult hatchery spring Chinook salmon have been held at the hatchery and outplanted into Shitike Creek each September. Other surplus fish are killed and distributed to the CTWSRO for tribal needs.

**7.6) Fish transportation and holding methods.**

Broodstock fish are held and spawned onsite at the hatchery. Fish designated for outplanting are loaded and sorted during spawning at the hatchery and are trucked to Shitike Creek in a 300 gallon tank truck by the CTWSRO.

**7.7) Describe fish health maintenance and sanitation procedures applied**.

All spring Chinook salmon held for broodstock are injected with erythromycin to prevent pre-spawning mortality by bacterial kidney disease (BKD) and to reduce vertical transmission of its causative agent to their progeny. Formalin is added to the water to control fungus and external parasites during the holding period. At spawning, tissues from adult fish are collected to ascertain viral, bacterial, and parasitic infections and to provide a brood health profile. Personnel from the Lower Columbia River Fish Health Center test for the parasite *Ceratomyxa shasta* and the listed pathogens as defined by USFWS Fish Health Policy and Implementation Guidelines: infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum* (BKD), *Aeromonas salmonicida, and Yersinia ruckeri*. All broodstock are tested and assayed for BKD and virus. If levels of BKD exceed prescribed standards, the progeny from the infected broodstock are either culled or kept segregated during rearing. Sanitation procedures meet or exceed the minimum guidelines set forth in the IHOT report (1995).

**7.8) Disposition of carcasses.**

Prior to spawning, surplus fish are distributed to the CTWSRO. After spawning, broodstock carcasses are either buried or used for stream nutrient enrichment. Prior to placement in streams, all carcasses are screened by health exams and treated (by evisceration and heat-baking) to prevent potential disease transmission.

**7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.**

No listed fish are used in the WSNFH spring Chinook salmon broodstock. Risk aversion measures for steelhead passage through the collection facility are discussed in Section 2.2.3.

## SECTION 8. MATING

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously**.

**8.1) Selection method.**

Spawners are randomly collected over the entire run and randomly spawned from ripe fish over a three to four week period.

**8.2) Males.**

Approximately 40% of the adults collected are males. The intent is to utilize a spawning population of 630 adults and to use a 1:1 male to female spawning ratio. Between 2% and 5% of the broodstock will be jacks, defined as males less than 60 cm in length.

**8.3) Fertilization.**

Ripe fish are separated out during spawning days at the hatchery. A 1:1 male to female spawning ratio is desired, however the actual ratio may differ based on the number of ripe individuals available.

Fluid is taken from each female, and carcasses of both males and females are checked by the fish health staff for signs of Bacterial Kidney Disease. If signs of gross Bacterial Kidney Disease are detected, the fish health staff informs the hatchery and the spawn products of those fish are removed from production. Eggs from each female are placed in separate numbered buckets and sperm from each male is placed in numbered baggies. Sperm is added to the eggs with approximately 16 ounces of water/sperm extender mix. The female number and male number is written on the bucket used to hold the egg/sperm mixture. The bucket of fertilized eggs is poured into a water/iodophor mixture and allowed to sit for 20 minutes. After the 20 minute waiting period fresh water is turned on the eggs. The eggs are then placed in a darkened room, supplied with a constant flow of water, and given weekly applications of formalin until eye-up. During this time the fertilized eggs from each female are kept separate.

**8.4) Cryopreserved gametes**.

No cryopreserved gametes are used.

**8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.**

No listed fish populations are used in broodstock collection or mating.

## SECTION 9. INCUBATION AND REARING -

**Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.**

## 9.1) Incubation:

### 9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1. Survival rates from egg to eye-up, egg to ponding, and ponding to release (CRiS Database 7/11/02).

| Brood Year | Eggs Taken | Eye-up (% Survival egg to eye-up) | Ponded (% Survival egg to ponding) | Released* (% Survival ponding to release) |
|---|---|---|---|---|
| 1992 | 619,102[A] | 594,108 (96%) | 583,540 (94%) | 551,151 (94%) |
| 1993 | 462,561 | 421,691 (91%) | 381,252 (82%) | 398,142 (--) |
| 1994 | 296,163[B] | 320,541[C] (97%) | 314,663 (95%) | 420,866 (--) |
| 1995 | 540,869[D] | 501,183 (93%) | 495,825 (92%) | 467,427 (94%) |
| 1996 | 1,047,542 | 818,624 (78%) | 809,586 (77%) | 790,422 (98%) |
| 1997 | 899,119 | 834,515 (93%) | 834,515 (93%) | 815,570 (98%) |
| 1998 | 1,039,781 | 992,764 (95%) | 830,194 (80%) | 770,419 (93%) |
| 1999 | 1,126,032 | 959,887 (85%) | 838,932 (75%) | 827,665 (97%) |
| 2000 | 857,836 | 739,910 (86%) | 731,465 (85%) | 618,822 (85%) |
| 2001 | 768,071 | 743,093 (97%) | 685,093 (89%) | -- |

*Number released is an actual count, other numbers are estimated from sample counts.
[A]853,102 eggs were taken, 234,000 were discarded.
[B]Includes 216,449 green eggs transferred from Round Butte Hatchery.
[C]Includes 34,413 eyed eggs transferred from Round Butte Hatchery.
[D]Includes 414,689 eggs transferred from Round Butte Hatchery.

### 9.1.2) Cause for, and disposition of surplus egg takes.

None

### 9.1.3) Loading densities applied during incubation.

5,000 eggs per Heath tray

**9.1.4) Incubation conditions.**

Eggs are kept at 50 degrees F, left undisturbed until eye-up, and then electronically counted, 5,000 per Heath tray.

9**.1.5) Ponding**.

At complete button-up (1,600 temperature units, 1,100 fish per pound) fry are moved into tanks. Ponding usually begins near the end of January and is completed by the end of February.

**9.1.6) Fish health maintenance and monitoring.**

Formalin is run through the watering system on the eggs until eye-up. After eye-up and during counting, dead eggs are removed by an electronic counter, weighed, sampled, and discarded. After counting, dead eggs are manually picked from the trays and subtracted from the egg count. At ponding, 60 fish are sampled for a health exam.

**9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.**

No listed fish are reared at Warm Springs NFH.

**9.2) Rearing:**

**9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.**.

See table 9.1.1

**9.2.2) Density and loading criteria (goals and actual levels).**

Pond densities range from a density index of 0.08 (approximately 0.44 lbs fish/$ft^3$) to a density index of 0.16 (approximately 0.88 lbs fish/$ft^3$), based on an average fish size of 20 fish/lb.

Density and loading criteria vary with annual production goals. Current production goals allow for density indices to be kept at or below 0.5, and flow indices to be within accepted standards for spring Chinook salmon (Piper et al. 1982)

**9.2.3) Fish rearing conditions**

Temperatures in the rearing ponds are monitored daily. Dissolved oxygen levels are monitored on a monthly, weekly, or daily basis as needed. Temperatures during the rearing cycle range from between 32 degrees F to 72 degrees F. Ponds are cleaned by brush twice a week during the summer.

**9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

Table 9.2.4. Monthly fish growth information for Brood Year 1999 (CRiS Database 7/11/02).

| Month | Length (in.) | #/lb | CF[A] | Conversion Rate[B] | $D_I$[C] | $F_I$[D] |
|---|---|---|---|---|---|---|
| Jan '00 | 1.41 | 1098 | | 0 | 0.47 | 1.55 |
| Feb '00 | 1.90 | 448 | | 0.3 | 0.83 | 2.72 |
| Mar '00 | 1.99 | 389 | | 6.89 | 0.30 | 0.89 |
| Apr '00 | 2.38 | 228 | | 1.95 | 0.03 | 0.10 |
| May '00 | 2.93 | 122 | | 1.60 | 0.05 | 0.15 |
| Jun '00 | 3.90 | 52 | | 0.80 | 0.09 | 0.27 |
| Jul '00 | 4.41 | 36 | | 1.49 | 0.12 | 0.35 |
| Aug '00 | 4.41 | 36 | | - | 0.12 | 0.35 |
| Sep '00 | 4.41 | 36 | | - | 0.12 | 0.35 |
| Oct '00 | 5.02 | 24 | | 0.65 | 0.15 | 0.45 |
| Nov '00 | 5.02 | 24 | | 1.11 | 0.15 | 0.45 |
| Dec '00 | 5.36 | 20 | | 0.19 | 0.17 | 0.52 |
| Jan '01 | 5.36 | 20 | | -1.06 | 0.16 | 0.49 |
| Feb '01 | 5.36 | 20 | | - | 0.16 | 0.49 |
| Mar '01 | 5.46 | 19 | | 3.86 | 0.17 | 0.50 |

[A]CF(Condition Factor)=standard spring Chinook CF of 3.24 taken from Piper et al. 1992
[B]Conversion Rate=lbs of monthly feed/lbs of monthly fish growth, conversion rates may not accurately reflect food conversion due to sampling methodology.
[C]$D_I$ (Density Index)=(weight of fish)/(fish length x volume)
[D]$F_I$ (Flow Index)=(fish weight)/(fish length x water inflow)

**9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available**.

See Table 9.2.4.

**9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).**

Biomoist grower and Biomoist feed is used during rearing. Erythromycin feed (21 days) is used in May and September. Feeding rates range from 1.5% to 3% B.W./day. Conversion rates averaged 1.62 for BY 1999.

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures**.

Fish health is monitored daily by hatchery staff. A fish health specialist visits at least once per month to examine fish in each lot, checking both healthy and symptomatic fish in the rearing ponds. If necessary, the appropriate chemotherapy or cultural changes are administered after consultation with the fish health specialist. Sanitation procedures follow guidelines established by the Fish Hatchery Management manual (Piper et al. 1982).

**9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

Not currently estimated. Future monitoring work may include smolt development indices.

**9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

Shade coverings have been installed over each rearing pond.

**9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.**

No listed fish are incorporated in the Warm Springs NFH spring Chinook salmon program.

## SECTION 10. RELEASE

**Describe fish release levels, and release practices applied through the hatchery program**.

### 10.1) Proposed fish release levels.

| Age Class | Maximum Number | Size (fpp) | Release Date | Location |
|---|---|---|---|---|
| **Eggs** | - | - | - | - |
| **Unfed Fry** | - | - | - | - |
| **Fry** | - | - | - | - |
| **Fingerling** | 75,000 | see Sect. 10.3 | Mid-October to Mid-November | Warm Springs River |
| **Yearling** | 750,000 | see Sect. 10.3 | March-April | Warm Springs River |

### 10.2) Specific location(s) of proposed release(s).

**Stream, river, or watercourse:** Warm Springs River
**Release point:** Warm Springs River NFH Rkm 16
**Major watershed:** Deschutes River Subbasin
**Basin or Region:** Columbia River Basin

## 10.3) Actual numbers and sizes of fish released by age class through the program.

Table 10.3. Juvenile release information for Warm Springs NFH by release year. Release dates are the last day of release during the release period (CRiS Database 5/06/02).

| Release Year | Spring Release Dates | Number Released | Avg. Fish/lb | Fall Release Dates* | Number Released | Avg. Fish/lb |
|---|---|---|---|---|---|---|
| 1990 | 04/11, 04/16 | 563,581 | 17.5 | 09/26, 11/01 | 254,513 | 10.7 |
| 1991 | 04/17, 04/22 | 816,420 | 14.8 | 11/04 | 8,521 | 6 |
| 1992 | 04/22 | 650,986 | 12 | 10/01, 11/16 | 47,257 | 21 |
| 1993 | 04/22 | 509,757 | 17 | 11/15 | 23,099 | 21 |
| 1994 | 04/20 | 527,565 | 16 | 11/16 | 16,497 | 13 |
| 1995 | 03/31 | 381,645 | 11 | 11/22 | 53,001 | 14 |
| 1996 | 04/10 | 367,885 | 11 | 11/13 | 30,394 | 12 |
| 1997 | 04/16 | 437,033 | 9 | 11/14 | 90,809 | 16 |
| 1998 | 04/15 | 699,613 | 22 | 11/09 | 35,718 | 20 |
| 1999 | 03/04 | 775,852 | 19 | 11/17 | 91,377 | 18 |
| 2000 | 04/19 | 679,042 | 15 | 11/15 | 42,921 | 22 |
| 2001 | 04/18 | 784,744 | 19 | 11/14 | 57,975 | 22 |

* Fall release is a volitional release of age 0+ spring Chinook salmon (see section 3.5). The number released is based on smolt trapping estimates made during the first year of the fall release program and pond estimates of fish released in the spring. Fall released fish are from the same brood year as fish released in the spring of the following year (e.g. fish released in fall '90 and spring '91 are both from BY '89).

## 10.4) Actual dates of release and description of release protocols.

See Table 10.3 for actual release dates. Release times were chosen to mimic the life history characteristics of the wild spring Chinook salmon population in the Warm Springs River (Olson et al. 1995). The fall release is a strictly volitional release while spring releases are a combination of volitional and forced releases.

**10.5) Fish transportation procedures, if applicable.**

All juvenile releases currently occur onsite at Warm Springs NFH. Beginning in 2000, approximately 200 adult fish have been outplanted into Shitike Creek annually. The adult fish are transported using a 300 gallon tank truck with aerated water.

**10.6) Acclimation procedures**

The water source for Warm Springs NFH is the Warm Springs River. Fish are reared and released onsite.

**10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.**

All hatchery fish receive an adipose-fin clip and a coded-wire tag before release. The tag retention goal is a minimum 95%.

**10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.**

No broodstock or eggs are taken beyond approved levels.

**10.9) Fish health certification procedures applied pre-release.**

Hatchery operations comply with the USFWS Fish Health Policy and Implementation Guidelines and the Integrated Hatchery Operations Team's Fish Health Policy. Three to six weeks prior to release, 60 fish from each lot are given a health exam. If fish are held longer than one month past the designated release date a second health exam is performed.

**10.10) Emergency release procedures in response to flooding or water system failure.**

Juvenile fish can be released onsite into the Warm Springs River in response to emergency conditions.

**10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.**

The goal of the Warm Springs NFH spring Chinook salmon program is to release functional smolts that will quickly migrate to the ocean. Releases are timed to mimic the life history characteristics of the wild population of spring Chinook salmon in the Warm Springs River (Olson et al. 1995). For a discussion of potential adverse impacts from the release program refer to Section 3.5.

## SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

**11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10**.

**11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.**

Refer to Section 1.10 for a discussion of how each "Performance Indicator" will be monitored and evaluated.

**11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

The USFWS expects to continue to fund monitoring and evaluation programs associated with Warm Springs NFH.

**11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

Potential take associated with monitoring and evaluation activities is discussed in Section 2.2.3. All monitoring and evaluation activities will attempt to minimize adverse effects to listed species.

## SECTION 12. RESEARCH

**Distribution, Migration Behavior, Habitat Use, and Species Interaction of Fall-Released Juvenile Hatchery Spring Chinook Salmon in the Deschutes River, Oregon.**

**12.1a) Objective or purpose.**

1.) Determine the over-wintering behavior and distribution of fall volitional releases of juvenile hatchery spring Chinook salmon in the Deschutes River.

2.) Determine the migration behavior of juvenile hatchery fish that leave the Deschutes River system and enter the Columbia River.

3.) Investigate hatchery spring Chinook salmon interactions among and between species during over-wintering.

**12.2a) Cooperating and funding agencies**.

Funding for this study is being provided by the USFWS. The United States Geological Survey (USGS) and the CTWSRO are taking the lead in conducting the study.

**12.3a) Principle investigator or project supervisor and staff.**

Principle Investigator: Rachel Wardell
Project Leader: Dennis Rondorf

USGS
Columbia River Research Laboratory
5501 A Cook-Underwood Road
Cook, WA 98605
509-538-2299

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CRFPO
9317 NE Highway 99, Suite I
Vancouver, WA 98665
360-696-7605

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P.O. Box C
Warm Springs OR
541-553-2045

**12.4a) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

Summer steelhead (*Oncorhynchus mykiss*), Mid-Columbia River ESU, threatened

Bull trout (*Salvelinus confluentus*), Columbia River distinct population segment, threatened

The status of summer steelhead in the Warm Springs River and Deschutes River is discussed in Section 2, the status of bull trout is discussed in Section 15.

**12.5a) Techniques: include capture methods, drugs, samples collected, tags applied**.

A complete discussion of sampling methodology can be found in Attachment A. Juvenile hatchery spring Chinook salmon will be collected at a rotary screw trap located at Rkm 5 of the Warm Springs River. The CTWSRO operate the trap as part of the monitoring and evaluation activities associated with the Warm Springs NFH (see Section 2.2.3). Only juvenile hatchery spring Chinook salmon will be used in the telemetry/PIT tag study. Fish will be collected during the fall trapping period, approximately 15 October to 15 November. Fish will be anesthetized using MS-222 and radio tags will be surgically implanted. Radio-tag size will be no larger than 6% tag weight to fish weight ratio. Up to 100 juvenile hatchery spring Chinook will be radio-tagged. Up to 1000 PIT tags will be applied to juvenile hatchery fish caught in the rotary screw trap. In addition, approximately 60 juvenile hatchery spring Chinook will be sampled for ATPase using non-lethal techniques.

Once fish are tagged they will be tracked throughout the Deschutes River and Columbia River using radio-telemetry and PIT tag monitoring. Three fixed telemetry-stations located on the Deschutes River will monitor movement of radio-tagged fish in the subbasin. Telemetry sites at The Dalles Dam and Bonneville Dam will scan for tagged fish in the mainstem Columbia River. Mobile telemetry receivers and a backpack PIT tag detector will be used for mobile tracking.

**12.6a) Dates or time period in which research activity occurs.**

Collection will occur between 15 October and 15 November in 2002. Tracking of tagged fish will take place from 15 October through January of the following year. The expected project duration is from 2002 through 2006.

**12.7a) Care and maintenance of live fish or eggs, holding duration, transport methods.**

Fish will be collected at the rotary screw trap. After fish are anesthetized and tags are implanted, fish will be placed in a recovery container and supplied with a constant flow of river water until they have recovered from the anesthetic. Fish will then be released back into the Warm Springs River, approximately 5 meters downstream of the rotary screw trap.

**12.8a) Expected type and effects of take and potential for injury or mortality.**

No additional take of listed species beyond that identified in Section 2.2.3 is anticipated as a result of this study. The rotary screw trap is operated as part of the monitoring and evaluation activities associated with Warm Springs NFH (see Section 2). Samples for this study will be taken from fish captured through the normal monitoring activities. Tracking of radio-tagged and PIT tagged fish will take place from the road or in boats and is not expected to result in any take of listed species.

**12.9a) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).**

Take associated with the monitoring and research program in the Warm Springs River is listed in Take Table 1 for listed steelhead and Take Table 3 for listed bull trout.

**12.10a) Alternative methods to achieve project objectives.**

None at this time.

**12.11a) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**

Similar species to summer steelhead and bull trout include spring Chinook salmon and resident rainbow trout. No mortality to these species is anticipated from this research project.

**12.12a) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

Non-lethal sampling techniques will be applied. The research project intends to use hatchery spring Chinook salmon to investigate potential impacts of hatchery activities on wild fish populations. The rotary screw trap is operated as part of the monitoring and evaluation activities associated with Warm Springs NFH (see Section 2). This research project will use fish collected during the normal monitoring activities. No additional listed fish will be sampled or handled as a result of the research project. Take estimates for steelhead resulting from the monitoring and evaluation program in the Warm Springs River are estimated in Take Table 1 and for bull trout in Take Table 3.

**Shitike Creek Outplanting Assessment Study**

**12.1b) Objective or purpose.**

1.) Assess the distribution and behavior of outplanted adult spring Chinook salmon in Shitike Creek.

2.) Estimate the reproductive success of natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek.

3.) Investigate potential ecological interactions between juvenile spring Chinook salmon, bull trout, and summer steelhead in Shitike Creek.

**12.2b) Cooperating and funding agencies**.

Funding for this study is being provided by the USFWS and the CTWSRO.

**12.3b) Principle investigator or project supervisor and staff.**

Principal Investigators:

Doug Olson
USFWS
9317 NE Highway 99, Suite I
Vancouver, WA 98665
360-696-7605

Bob Spateholts
CTWSRO
P.O. Box C
Warm Springs, OR 97761
541-553-2045

**12.4b) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

Summer steelhead (*Oncorhynchus mykiss*), Mid-Columbia River ESU, threatened

Bull trout (*Salvelinus confluentus*), Columbia River distinct population segment, threatened

The status of summer steelhead in the Warm Springs River and Deschutes River is discussed in Section 2. The status of bull trout in the proposed work area is discussed in Section 15.

**12.5b) Techniques: include capture methods, drugs, samples collected, tags applied**.

A complete sampling design is included in Attachment B. Adult spring Chinook salmon will be trapped using a temporary adult weir located near the mouth of Shitike Creek. The weir is currently being operated by the CTWSRO as part of a bull trout study funded by the Bonneville Power Administration. The adult weir is typically installed in late April or early May and operated through September. In order to minimize mortality of fish held in the weir trap box, the weir is taken out of operation if stream temperatures rise above an average of 17 degrees Celsius. Adult steelhead typically enter Shitike Creek prior to installation of the weir. Steelhead kelts are passed downstream of the weir. Sampling of bull trout is conducted as part of the CTWSRO bull trout project. Scale samples, lengths, and tissue samples will be collected from every spring Chinook salmon trapped at the weir. Spring Chinook will be tagged with a numbered floy tag and released upstream of the weir. Hatchery spring Chinook salmon will be sampled at the hatchery before outplanting. Approximately 20 hatchery spring Chinook salmon will be implanted with radio-tags in order to track their movement after outplanting. Redd surveys and telemetry monitoring will occur on a weekly basis from late August through September.

Juvenile fish will be monitored through snorkeling, seining, electrofishing, or migrant trapping. Microhabitat use, species association, and interspecific interactions will be monitored using snorkel observations at approximately 20 locations throughout Shitike Creek. In addition, a rotary screw trap located near the mouth of Shitike Creek will monitor juvenile fish outmigration during the spring and fall. The rotary screw trap is operated as part of the CTWSRO's bull trout study. The outplanting evaluation study will use the screw trap to collect tissue samples from approximately 1000 juvenile spring Chinook salmon per year. Tissue samples (fin clips) will be collected during the normal measuring and marking activities associated with the screw trap (see Section 2). Fin clips from age 0+ spring Chinook salmon will be collected from Shitike Creek during the months of June and July. It is anticipated that juvenile spring Chinook salmon will be collected using seining or minnow trapping techniques. Snorkelers will enter the creek and "herd" juvenile fish towards a seine, where they will be collected, sampled, and released. Seining will not take place in areas with a high abundance of listed species.

The feasibility of collecting juvenile Chinook using minnow traps will be investigated. Minnow traps will be placed in slow water sections and baited with food. Traps will be checked every 45 minutes. Juvenile fish will be marked and sampled using the same protocol as with the screw traps. Fish will then be returned to the stream. If seining and minnow trapping prove to be ineffective, electrofishing may be used. Electrofishing will be conducted only after consultation with the National Marine Fisheries Service and the USFWS. The USFWS and the CTWSRO will follow all applicable electrofishing guidelines in order to reduce potential take of listed species.

**12.6b) Dates or time period in which research activity occurs.**

Adult collection will occur at the temporary weir from approximately 1 May to 30 September. Juvenile trapping will occur in the spring, approximately March through June, and in the fall, approximately October through November. Snorkel observations are scheduled to begin in late June and early July, 2002. Age 0+ sampling will begin in June or July, 2003. The project is expected to begin in 2002 and continue through 2006.

**12.7b) Care and maintenance of live fish or eggs, holding duration, transport methods.**

Fish will be collected at the rotary screw trap. After fish are anesthetized and samples are taken they are placed in a recovery bucket. Once fish have fully recovered from the anesthetic they are carried upstream and released back into the creek. Fish are held in the trap for less than 24 hours and typically held for sampling less than one hour. Fish collected during seining or minnow trapping will be held in freshwater until they are fully recovered from the sampling. Fish will then be released back into the stream in the same habitat unit that they were collected from.

**12.8b) Expected type and effects of take and potential for injury or mortality.**

Potential take as a result of the weir operation may include handling stress and delayed migration of bull trout and summer steelhead. Operation of the weir will be discontinued if stream temperatures rise above an average of 17 degrees Celsius. Take associated with the rotary screw trap may include handling stress, delayed migration, and mortality associated with trap malfunction.

**12.9b) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).**

Take associated with the monitoring program in Shitike Creek is included in Take Table 2 for listed steelhead and Take Table 4 for listed bull trout.

**12.10b) Alternative methods to achieve project objectives.**

None at this time.

**12.11b) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**

Similar species to summer steelhead and bull trout include spring Chinook salmon and resident rainbow trout. No mortality of these species is expected as a result of this study.

**12.12b) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

Juvenile and adult traps will be checked on a daily basis in order to minimize the holding time for listed fish. If high flows are anticipated, the traps will be taken out of operation in order to minimize the likelihood of injury due to trap malfunction or debris overload. Other risk aversion measures include snorkeling for passive fish observation and genetic tissue sampling of only unlisted hatchery spring Chinook salmon. If electrofishing is used, all applicable NMFS and American Fisheries Society guidelines will be followed.

## SECTION 13. ATTACHMENTS AND CITATION


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CRiS (Columbia River Information System) Database, Stephen Pastor Database Manager (Stephen_Pastor@fws.gov), United States Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington. http://columbiariver.fws.gov

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## SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

# Attachment A:
## Juvenile Fall Release Evaluation Proposal

Title: Distribution, Migration Behavior, Habitat Use, and Species Interactions of Fall-Released Juvenile Hatchery Spring Chinook Salmon on the Deschutes River, Oregon


| | |
|---|---|
| Principal Investigators: | Rachel E. Wardell and Patrick J. Connolly |
| Project Leaders: | Noah S. Adams and Dennis W. Rondorf |
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| E-mail: | Rachel_wardell@usgs.gov, noah_adams@usgs.gov,<br>dennis_rondorf@usgs.gov |
| Submitted to: | Doug Olson<br>U.S. Fish and Wildlife Service<br>Columbia River Fisheries Program Office<br>9317 Highway 99, Suite I<br>Vancouver, WA 98665<br>doug_olson@fws.gov<br>(360) 696-7605; Fax (360) 696-7968 |
| Administrative Contact: | Michele F. Beeman<br>U.S. Geological Survey, Biological Resources Division<br>Columbia River Research Laboratory<br>5501A Cook-Underwood Road<br>Cook, WA 98605<br>(509) 538-2299;Fax (509) 538-2843 |
| Performance Period: | July, 2002 through August 30, 2003 |

## BACKGROUND AND JUSTIFICATION

The U.S. Fish and Wildlife Service's (USFWS) review of National Fish Hatcheries (NFH) practices identified a need to assess the fate of hatchery-reared fish and their potential effect on the aquatic community (USFWS 1998). Additionally, the National Marine Fisheries Service (NMFS) recommended monitoring and evaluation of ecological interactions between hatchery and wild fish (NMFS 1999; Columbia River Biological Opinion). In response to these recommendations and findings, the U.S. Geological Survey (USGS), BRD, conducted a pilot study in 2000, designed to investigate the potential effect of hatchery-reared fish released from the Warm Springs NFH on the aquatic community in the Deschutes River. Results of this study indicated that this type of investigation was feasible and have prompted interest in funding additional research. The second year study is designed to further investigate the fate of hatchery-reared fish and assess habitat use and fish interactions.

Warm Springs NFH is a unique program in the Columbia River basin. The operation of the hatchery is considered pivotal for enhancing salmon stocks to meet tribal trust responsibilities**,** and is also managed to preserve the genetic integrity and characteristics of hatchery and wild fish. Managers are concerned about fall releases of juvenile spring chinook salmon because hatchery fish that over-winter in the Warm Springs and Deschutes Rivers may interact with wild fish. However, quantifying the freshwater fate of juvenile chinook salmon, *Oncorhynchus tshawytscha,* released in the fall from Warm Springs NFH has been problematic (Olson et al. 1995). Typically, about 10% of the hatchery production volitionally exits the hatchery in the fall (30,000 to 75,000 fish). In the past, this fall emigration (early October - early November) included a mixture of sizes, ranging from 70 mm to 229 mm, with the majority of fish being 140 mm or larger (USFWS 1999). Most fish released in the spring reach the Columbia River estuary within 3-4 weeks of release, whereas the destination of fish volitionally released in the fall is not clear. Cates (1992) indicates that fish from the fall release survive and contribute to adult production. Sampling in the lower Deschutes River, at Bonneville Dam, and in the Columbia River estuary indicates that fish released in the fall can exit the Deschutes River during the fall, winter, or spring periods. Recent scale analysis shows that most fall-released fish surviving to adulthood have over-wintered in freshwater before migrating to the ocean in the spring (J.Fryer, Columbia River Inter-Tribal Fish Commission, personal communication). Although the fall volitional release strategy has been successful in contributing to adult returns (Olson 1998), managers are concerned that large numbers of hatchery fish rearing in the Deschutes River may negatively affect the freshwater aquatic community. These over-wintering hatchery salmon could displace or compete with wild fish in the Deschutes River.

In 2000, we conducted a pilot study to determine the distribution of fall-released fish in the Deschutes River and investigate methods to assess habitat use. Fifty-four fish were implanted with radio transmitters and tracked for 45-75 days. Over the study period, we found that 65% of the radio-tagged fish remained in the Deschutes River, indicating that there were a substantial number of fish remaining over the winter. With the majority of fish remaining in the Deschutes, there could be a potential impact on wild juvenile spring chinook salmon, bull trout, steelhead, rainbow trout, and other resident fish. Habitat assessments conducted during the pilot study at sites where radio-tagged fish were found indicated that these fish select discrete microhabitat. If there is interspecies overlap in microhabitat use and potential antagonistic behavior caused by hatchery-released fish, managers may need to review current practices. However, if there is not much interaction or overlap in microhabitat use, the hatchery-released fish may be able to coexist

in the Deschutes River. The proposed study is intended to expand the work conducted in 2000 and further develop the habitat and ecological interactions assessment. The study will focus on determining the distribution of fall-released hatchery spring chinook salmon, assessing microhabitat, addressing potential interactions within the fish community in the Deschutes River, and assess possible ways of quantifying habitat.

## OBJECTIVES AND METHODOLOGY

**Objective 1:** Determine the over-wintering behavior and distribution of fall volitional releases of juvenile hatchery spring chinook salmon in the Deschutes River.

**Task 1.1:** Use radio telemetry techniques to track fish throughout the Lower Deschutes River. We propose to tag 100 fish (Two size groups, 50 fish each).

Subtask 1.1.1: Select a suitable radio tag.

Activity: Consult with Lotek Engineering and Advanced Telemetry Systems (ATS). Research tag attributes (burst interval, battery life, dimensions, weight) as well as special options (activation programming, delayed wake up, and slower burst rate) to find a tag suitable for desired fish size and length of study.

*Schedule:*

May through July, 2002

Subtask 1.1.2. Surgically implant radio tags in 100 juvenile hatchery spring chinook salmon.

Activity: Trap juvenile hatchery chinook salmon, in conjunction with personnel from the Confederated Tribes of Warm Spring, in the Warm Springs River and select from two distinct groups: 50 fish between 120 mm and 149 mm, and 50 fish 150 mm and larger. Surgically tag fall-released fish as described by Adams (1998). Record biological measurements including length, weight, and overall condition.

*Schedule:*

October 15 through November 15, 2002

Subtask 1.1.3. Determine travel times of radio-tagged fish from tagging location to fixed locations along the Deschutes River.

Activity: Set up and test four fixed-site receiving stations at predetermined locations on the banks of the Deschutes River. Aerial antennas and receivers will be positioned at locations downriver of the tagging site on the Deschutes River. Proposed monitoring locations: Mouth of Deschutes River(rkm 2), Oak Springs Hatchery (rkm 84), near the mouth of the Warm Springs River (rkm 130), and upstream of the confluence of the Warm Springs River (rkm 140). Receivers will be downloaded onto laptop computers 1-2 times per week.

*Schedule:*

October1 through October 15, 2002

Subtask 1.1.4. Monitor fish movements, using vehicles and boats, in the Deschutes River.

Activity: Set up mobile-tracking equipment on vehicle and boat to allow us to monitor small-scale movements of fish. Equipment will include YAGI antenna and receiver. Once a fish is located, we will record a GPS position and mark the location on a map.

*Schedule:*

November 1, 2002 through January 2003

**Task 1.2:** Conduct physiological sampling (ATPase) before fall volitional release (hatchery) and at the migrant trap to determine developmental condition before and during time of migration out of the Warm Springs River.

Subtask 1.2.1. Determine developmental condition of fish in the hatchery at time of volitional releases.

Activity: Collect and sample a total of 360 fish (60 each from six raceways) at the hatchery. Sampling will take place concurrently with the U.S. Fish and Wildlife Health Center. No additional fish will be sampled.

*Schedule:*

October through November 2002

Subtask 1.2.2. Determine developmental condition of fish during migration in the Warm Springs River.

Activity: Collect juvenile hatchery chinook salmon at the downstream migrant trap in the Warm Springs River concurrently with radio tagging. We will use non-lethal techniques, as described in Schrock et al (1994), to sample 60 fish representing each of the two radio-tagged size groups. Fish that are non-lethally sampled are not used in the telemetry portion of the study.

*Schedule:*

October through November 2002

**Task 1.3:** Determine habitat characteristics of areas where radio-tagged fish are holding.

Activity: Conduct habitat assessment in areas where radio-tagged fish are found holding. Macrohabitat descriptors at fish locations include habitat unit descriptions, substrate type, percent cover, and bank association of fish and habitat type, as described by Baine and Stevenson (1999).

*Schedule:*

November 2002 through January 2003

**Objective 2**: Determine the migration behavior of fish that leave the Deschutes River system and enter the Columbia River.

**Task 2.1:** Monitor fish movements on the Columbia River below The Dalles and Bonneville Dams, using radio telemetry fixed-site stations.

Activity: Use existing U.S. Geological Survey telemetry receiving arrays at various locations along the Columbia River. Aerial antennas and receivers will be positioned at locations downstream of the Deschutes River. Proposed locations: Below The Dalles Dam (rkm 318), and Bonneville Dam (rkm 242). Receivers will be downloaded onto laptop computers and maintained 1-2 times per week.

*Schedule:*

November 1 2002 through January 2003

**Objective 3:** Determine feasibility of using PIT-tag technology to determine distribution of juvenile hatchery spring chinook salmon in the Deschutes River.

**Task 3.1:** PIT-tag fish at the downstream migrant trap to incorporate a wider size range of fish representative of those that are volitionally released from the hatchery.

Task 1.1. Develop remote and backpack PIT-tag readers to track time and size at release, travel time, residence time, and habitat use.

Activity: Portable Passive Integrated Transponder (PIT tag) detection systems have been developed to monitor individual fish movements within a stream (similar to those in: Zydlewski et al. 2001; Roussel et al. 2000). This allows exact location information for fish that do not move during high water events or at the end of a predicted migration. This system is currently being used to monitor habitat use, winter survival, and level of residualization of coho salmon, cutthroat trout, and steelhead trout in Abernathy Creek (a tributary of the Columbia River). Similar application of this backpack unit may be applied in the Deschutes River to assess distribution and migration behavior of fish that are smaller than the minimum size of radio-tagged fish. The backpack unit has been shown to be able to locate an individual fish to within a 15 $cm^2$ area. Individual areas and microhabitats are mapped and characterized for each fish. Habitat characterization is completely dependent on the behavior of the detected fish.

*Schedule:*

November 1 2002 through January 2003

**Objective 4:** Investigate techniques to determine hatchery chinook interactions among and between species during over-wintering .

**Task 4.1:** Determine the feasibility of quantifying available habitat in the Deschutes River for future analysis of ecological interaction among and between species, ultimately assessing carrying capacity

Subtask 4.1.1. Document habitat overlap of radio-tagged fish with other fish species.

Activity: Compare Macrohabitat and site-specific surveys used by radio-tagged fish with habitat use identified by other agencies. Review past habitat assessments conducted by Oregon Department of Fish and Wildlife, Bureau of Land Management, The Confederated Tribes of the Warm Springs Reservation, Oregon, PGE, and other agencies working in the Deschutes River Basin, to determine if radio-tagged fish are using similar habitats to other species.

*Schedule:*

November 2002 through January 2003

Subtask 4.1.2. Use GIS technology to quantify available habitat in the Lower Deschutes River.

Activity: Investigate available GIS resources (i.e. aerial photographs, topographic maps, etc.) to determine feasibility of quantifying habitat availability using GIS software (ArcView or similar technology).

*Schedule:*

January through February, 2003

**Task 4.2:** Conduct literature review of behavioral interaction studies of juvenile salmonids.

Activity: The relevant literature from the behavioral and fisheries sciences will be reviewed to summarize research on behavioral interactions between various species of salmonids, with an emphasis on the influence of hatchery spring chinook salmon on other fish. The focus of this review will be to describe: (1) the types of interaction studies that have been done; and (2) the various experimental systems that have been used to conduct such studies. Included will be a discussion of the advantages, disadvantages, and design considerations of the various experimental systems (e.g., aquaria, mesocosms, in-stream enclosures) used to conduct such studies. The goal of this review is to help plan and guide future species interactions studies that may occur within the scope of the Warm Springs-Deschutes River research plan.

*Schedule:*

A draft version of the review will be completed by December 31, 2002.

## FACILITIES AND EQUIPMENT

The USGS Columbia River Research Laboratory is equipped with many of the resources necessary to successfully complete this study. Personnel with extensive experience in state of the art radio-telemetry research are available for assistance. Laboratory and office space and equipment, including desktop computers and software are available. In addition, we have a state of the art GIS computer system and software at the lab. A variety of field equipment, including telemetry receivers, research boats and rafts, and a fleet of vehicles are available. **Boats will be operated at no cost with no additional lease cost to the project**. Only Department of Interior (DOI) certified boat operators trained in CPR and First Aid will operate DOI boats.

Furthermore, USGS will provide a quality control system consistent with the Good Laboratory Practices Act.

**SPECIAL PROVISIONS**

ESA consultation, and state permits will be applied for and obtained prior to conducting field work. An on-site job hazard analysis will be conducted to ensure project safety.

**COOPERATORS/PARTNERS**

Through our cooperative efforts we can efficiently carry out this research. Warm Springs National Fish Hatchery works closely with the U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office on hatchery evaluation. Together they have formed working relationships with the Oregon Department of Fish & Wildlife (ODFW) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO). The U.S. Fish and Wildlife Service, CTWSRO, and U.S. Geological Survey will be cooperators and some of their participation will be covered under other existing or new programs. Working together, we can contribute through cooperation on tasks including trapping, tagging, physiological assessment**,** tracking, instream sampling, data analysis, and reporting. Using existing equipment and resources, costs will be minimized. For example, **the Columbia River Research Laboratory of the Biological Resources Division would be loaning $140,000 worth of equipment to conduct this study.** The U.S. Fish & Wildlife Service and CTWSRO will be allocating resources for planning, sampling, analysis & reporting, along with capital equipment such as a downstream migrant trap, boats, and rafts.

**LIST OF KEY PERSONNEL AND PROJECT DUTIES**

| Personnel | Organization | Project Duties |
|---|---|---|
| Dennis Rondorf | BRD | Project Leader |
| Doug Olson | USFWS | FWS Project coordinator |
| Noah Adams | BRD | Project Leader |
| Rachel Wardell | BRD | Principal Investigator (Radio telemetry Lead, project coordination) |
| Robin Schrock | BRD | Physiology Lead |
| Patrick Connolly | BRD | Principal Investigator (Habitat/PIT-tag Lead) |
| Matthew G. Mesa | BRD | Species Interactions Lead |
| Bob Spateholts | CTWSRO | Cooperator (project coordination and support) |
| Gayle Zydlewski | USFWS | Cooperator (PIT-tag) |

**SAMPLING SCHEDULE**

| | October | November | December | January |
|---|---|---|---|---|
| Tagging of juveniles | 5-10 days | | | |
| ATPase sampling | 5-10 days | | | |
| Vehicle and boat surveys | | Every week | Every week | Every week |
| Fixed-site downloading | | Every week | Every week | Every week |
| Habitat assessments | | 2 days/week | 2 days/week | 2 days/week |

**REPORTING DEADLINES**

Draft Report: 23 May, 2003
Review Comments 30 June, 2003
Final Report 11 August, 2003

**REFERENCES**

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# Attachment B:
# Shitike Creek Outplanting Evaluation Proposal

**Background/Justification:**

Shitike Creek and the Warm Springs River are the only tributaries of the Deschutes River that currently support successful natural spawning of spring Chinook salmon (*Oncorhynchus tshawytscha*). The density, or redds per mile, of spawning spring Chinook in Shitike Creek has generally been lower than in the Warm Springs River and it is thought that the habitat is under seeded (Lindsay *et al*. 1989). Habitat improvement and fish passage projects have been ongoing in Shitike Creek since the 1980's. A man made barrier blocking the upper reaches of the drainage was removed in 1983 and a natural cascade was removed to improve adult passage. Despite these improvements natural production in the drainage remained at relatively low levels. Indexed redd counts in Shitike Creek, conducted yearly since 1978, ranged from a low of six in 1996 to a high of 33 in1997 (CTWSRO unpublished data).

In 2000, the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and the United States Fish and Wildlife Service (USFWS) initiated an adult spring Chinook outplanting program designed to increase natural production of spring Chinook in Shitike Creek. Adult hatchery spring Chinook returning to the Warm Springs River are trapped at the Warm Springs National Fish Hatchery (WSNFH) and are held in the hatchery until late August or early September. Hatchery personnel then sort the adults for hatchery broodstock collection with some surplus hatchery fish collected for outplanting into Shitike Creek. Outplanted fish are released at various locations within Shitike Creek during early September and are allowed to spawn naturally. The goal of the program is to annually release approximately 120 adult spring Chinook at up to five locations within Shitike Creek. The number of fish released and the locations of release were based on the estimated amount of suitable spawning habitat in selected stream reaches. In 2000, the first year of spring Chinook outplanting, 110 males and 49 females were released into Shitike Creek. Spawning ground surveys for 2000 counted 52 spring Chinook redds, the highest number of redds observed since surveys began in 1978 (CTWSRO unpublished data).

The contribution of the outplanted fish to the spawning population is not known but it is assumed that some of the outplanted fish successfully spawned. Outplanted hatchery fish are selected from hatchery fish at WSNFH, whose life history traits closely mimic those of the wild population in the Warm Springs River (Olson and Spateholts 2001). The spawning success of hatchery spring Chinook from WSNFH is not known since WSNFH is primarily managed to conserve the wild populations in the Warm Springs River and the majority of hatchery fish are held at the hatchery and not allowed to spawn naturally. Several studies have shown a difference in behavior between wild and hatchery adult fish. Burgert *et al*. (1991) reported that wild adults behaved differently from hatchery adults in the Tucannon River and selected spawning sites further upstream than hatchery fish. Since salmon mating is non-random, any differences

in aggressiveness, size, spawning time, or other life history trait between hatchery and wild fish could potentially limit the amount of interbreeding (Quinn 1999).

The proposed project will evaluate the outplanting program in Shitike Creek and provide information on ecological interactions between spring Chinook and other fish species. The distribution and behavior of outplanted adult hatchery spring Chinook will be monitored using radio-telemetry techniques and intensive spawning ground surveys. A subsample of outplanted fish will be externally outfitted with radio-tags and tracked through spawning. The redd location, redd characteristics, spawn timing, and mate choice of outplanted spring Chinook will be compared to natural-origin spring Chinook in Shitike Creek. The reproductive success of outplanted fish will be estimated based on genetic pedigree analysis. Fin clips from outplanted hatchery-origin and natural-origin spring Chinook will be analyzed in order to estimate the contribution of each individual fish to the juvenile outmigrant population and subsequent adult returns. In addition, snorkel surveys will document juvenile microhabitat preferences and behavioral interactions between spring Chinook salmon, summer steelhead, and bull trout. The information gathered from this project will help evaluate the success of the outplanting program and provide information for future management options in Shitike Creek.

This project will be a cooperative project involving USFWS and CTWSRO personnel, with funding provided by the USFWS. Field work for the adult and juvenile behavioral observations is expected to begin in the summer of 2002 and continue for one to three years. The genetic pedigree analysis of reproductive success will begin with the 2002 brood year and continue for three complete brood. A summary of the project design is being included in the Warm Springs Hatchery and Genetic Management Plan as part of the National Marine Fisheries Service and USFWS ESA consultation requirements.

**Goal:** Evaluate the spring Chinook outplanting program in Shitike Creek.

**Objective 1**. Assess the distribution and behavior of outplanted spring Chinook salmon in Shitike Creek.

Task 1.1. Tag hatchery spring Chinook salmon prior to outplanting with colored floy tags and/or radio tags.

Activity: Externally radio-tag a subsample of outplanted hatchery spring Chinook salmon using the methodology of Nigro and Ward 1985. Radio-tags will be encased in a heat-shrink tubing and externally attached to the fish at a point just below the anterior portion of the dorsal fin. Approximately six loads of fish (25 fish/load) will be outplanted into Shitike Creek. Three to four fish will be radio-tagged per load, for a total of 18-24 radio-tagged fish.

Schedule: August 19-September 7. Tagging will take place during sorting of outplanted fish at the hatchery.

Task 1.2. Determine the distribution of radio-tagged spring Chinook salmon in Shitike Creek.

Activity: Track radio-tagged fish using mobile-tracking equipment and fixed telemetry base stations. Radio-tagged fish will be tracked upon release into Shitike Creek using a portable Lotek receiver and YAGI antenna. Once a fish is located, the location will be recorded using a GPS system and marked on a map. A fixed base-station will be set up near the mouth of Shitike Creek in order to monitor fallback of radio-tagged fish out of the system. Radio-tagged fish will be tracked until initiation of spawning activity. When fish move onto redds, the redds will be flagged and recorded on a map.

Schedule: Late August through September, 1-2 days/week. Radio tracking will take place on a weekly basis as fish are outplanted and continue through spawning.

Task 1.3. Compare the spawn timing of wild and outplanted spring Chinook salmon in Shitike Creek.

Activity: Conduct spawning surveys on indexed stream reaches in order to estimate spawn timing of wild and outplanted spring Chinook. Surveys on indexed stream reaches will supplement the CTWSRO spring Chinook spawning surveys. Surveys will flag all redds encountered, identify the origin of all spring Chinook observed, and estimate the length of residence for fish found on redds.

Schedule. Late August through September, one day per week. Index surveys will begin before outplanting and continue through the end of spawning.

Task 1.4. Determine the mate choice and redd characteristics of outplanted spring Chinook salmon.

Activity: When spawning fish are found either through radio-telemetry or spawning surveys, the origin of the mate will be recorded as either outplanted or wild. If carcasses of fish are found, the carcasses will be examined in order to estimate spawning success based on gamete retention. Once redds have been abandoned the length, width, substrate size, water depth, and water velocity will be measured at each redd location.

Schedule: Late August through September, 2 days per week.

**Objective 2**. Estimate the reproductive success of natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek using genetic pedigree analyses.

Task 2.1. Collect fin clips for genetic analysis from all natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek.

Activity: Trap all upstream-migrating spring Chinook adults in Shitike Creek via an adult weir. The weir is currently being operated by the CTWSRO as part of a bull trout project. During the spring Chinook migration, the weir will be operated seven days per week and all adult spring Chinook migrating upstream will be trapped and sampled. Length measurements, scale samples, and fin clips will be collected. Fin clips, approximately a 1 $cm^2$ area, will be taken from the caudal or pectoral fin and preserved in 100% ethanol. Fish will then be tagged with a numbered floy tag and be passed upstream. Outplanted hatchery-origin spring Chinook will be sampled at the hatchery as the fish are sorted for outplanting. Data collection for outplanted fish will be the same as for natural-origin fish. Data collection is expected to continue for three complete brood cycles.

Schedule: The adult weir will be operated seven days per week from May through August through 2008.

Task 2.2. Collect fin clips from a minimum 1,000 juvenile spring Chinook outmigrants per brood year.

Activity: Juvenile spring Chinook outmigrants will be sampled at a rotary screw trap located near the mouth of Shitike Creek. Fin clips will be collected from subyearling and yearlings proportionately throughout the outmigration period. Scale samples and lengths will be used to determine brood year.

Schedule: May-June, October-November 2003, 2004, 2005, 2006

Task 2.3. Collect fin clips from subyearling spring Chinook salmon in Shitike Cr.

Activity: Subyearling spring Chinook will be collected from sampling locations in Shitike Creek during the summer months. Fish will be collected either by electro-fishing or seining. Fin clips, scale samples, and lengths will be collected.

Schedule: June-July 2003, 2004, 2005.

Task 2.4. Determine genotypes of all adult spring Chinook upstream of the weir and a subsample of juveniles outmigrating from Shitike Creek.

Activity: Determine multi-locus genotypes at 10-15 microsatellite nuclear DNA loci for each adult spring Chinook salmon upstream of the weir. Analyze similar data for a minimum of 1,000 progeny of each brood year and determine the parent of each juvenile fish via DNA assignment tests and pedigree analyses. Continue for three complete brood cycles to evaluate the return rate of the progeny of natural-origin and outplanted hatchery-origin adults.

Schedule: Completed by 2005.
Personnel: USFWS, CTWSRO

**Objective 3**. Evaluate habitat use and ecological interactions between juvenile spring Chinook salmon, juvenile summer steelhead, and bull trout in Shitike Creek.

Task 3.1. Select sampling reaches and determine microhabitat use in selected sampling units.

Activity: Shitike Creek will be divided up into three sampling reaches based on CTWSRO and ODFW habitat and abundance surveys. The upper reach will coincide with the uppermost spring Chinook outplanting location, around Peters Pasture (RM 25). The middle reach will be between Upper Crossing (RM 10.3) and Headworks (RM 7.5), while the lower reach will be below Headworks. Within each reach approximately eight sampling units, consisting of a pool-riffle combination, will be selected. Microhabitat use will be determined using the methodology of Underwood et al. 1995 and the CTWSRO. Units will be snorkeled and for each fish observed the species, estimated size, and general behavior will be recorded. A marker will be placed at the focal point for each fish. Once the unit has been snorkeled, microhabitat characteristics will be measured at each focal point. Microhabitat measurements will include substrate type, depth of stream, depth of the fish, nearest cover type, distance to nearest cover, and the distance to the nearest fish.

Schedule: June-July and possibly October-November.

Task 3.2. Determine the frequency of association for juvenile spring Chinook salmon, juvenile summer steelhead, and bull trout.

Activity: Species assemblage will be recorded at each sampling location during the microhabitat surveys. Using the methodology of Pearsons et al. 1996, pods of fish, defined as two or more fish within 30 cm of each other will be recorded. The percent species association will be defined as the number of times that one species is found within the same pod as a second

species divided by the number of times the second species was observed. Species association will be determined for each stream reach (upper, middle, and lower).

Schedule: Concurrent with the microhabitat surveys.

Task 3.3. Determine the behavioral interactions between juvenile spring Chinook salmon, juvenile summer steelhead, and bull trout.

Activity: Use snorkeling techniques to observe behavioral interactions in pods of fish consisting of at least two different species. Data that will be collected will include the initiator of the interaction, the relative sizes of the fish involved, the type of interaction, and the outcome of the interaction (Pearson et al. 1996). Other methods of recording interactions between species will be investigated. Methods for determining predation rates on juvenile spring Chinook salmon, such as non-lethal stomach sampling of bull trout, may be used after consultation with the Hatchery Evaluation Team and the Fish and Wildlife Committees.

Schedule: June-July, possibly October-November. Observations will not take place on days when microhabitat sampling occurs.

**Objective 4**. Produce annual reports that evaluate the spring Chinook outplanting program in Shitike Creek.

Task 4.1. Summarize data and produce an annual report that describes the progress towards achieving Objectives 1-3. Annual and final reports will be provided to Hatchery Evaluation Team members and the Fish and Wildlife Committee.

Schedule: Annual reports will be provided in time for the annual meeting in March.

# Sampling Schedule

## Objective 1

Adult Distribution/Behavior (2002)

| | Aug. 18-24 | Aug. 25-31 | Sept. 1-7 | Sept. 8-14 | Sept.15-21 | Sept. 22-28 |
|---|---|---|---|---|---|---|
| Tagging-<br>Personnel- | 1 day<br>3 people | 1 day<br>3 people | 1 day<br>3 people | | | |
| Telemetry-<br>Personnel- | 2 days<br>2 people | 2 days<br>2 people | 2 days<br>2 people | 2 days<br>2 people | 2 days<br>2 people | |
| Surveys-<br>Personnel- | 1 day<br>3-4 people | 1 day<br>3-4 people | 1 day<br>3-4 people | 1 day<br>3-4 people | 1 day<br>3-4 people | |
| Redd meas.-<br>Personnel- | | | | | 2 days<br>2 people | 2 days<br>2 people |

## Objective 2

Reproductive Success

| | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
|---|---|---|---|---|---|---|---|
| Adult weir | | | | | | | |
| Hatchery outplants | | | | | | | |
| Juvenile Outmigrants | | | | | | | |
| Subyearlings in Shitike Cr. | | | | | | | |

## Objective 3

Juvenile Microhabitat/Interactions (2002)

| | June | July | August | September | October | November |
|---|---|---|---|---|---|---|
| Microhabitat | 6 days<br>3-4 people | 6 days<br>3-4 people | | | 6 days<br>3-4 people | 6 days<br>3-4 people |
| Species Assemblage | -- | -- | | | -- | -- |
| Species Interactions | 3 days<br>3-4 people | 3 days<br>3-4 people | | | 3 days<br>3-4 people | 3 days<br>3-4 people |

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## **Attachment C**:

Federal and Oregon listing status of wildlife species in the lower Dechutes River subbasin below Pelton Dam (ODFW 2001).

| Species | Federal Listing Status | Oregon Listing Status |
|---|---|---|
| **Amphibians** | | |
| Cascade frog *Rana cascadae* | Species of Concern | Sensitive |
| Northern leopard frog *Rana pipiens* | | Sensitive |
| Northern red-legged frog *Rana aurora aurora* | Species of Concern | Sensitive |
| Oregon spotted frog *Rana prettosa* | Proposed Threatened | Sensitive |
| Western toad *Bufo boreas* | | Sensitive |
| **Reptiles** | | |
| Northern sagebrush lizard *Sceloporus graciosus graciosus* | Species of Concern | |
| Western pond turtle | Species of Concern | Sensitive |
| **Birds** | | |
| American Peregrine falcon *Falco peregrinus anatum* | Endangered | Endangered |
| Bald eagle *Haltaeetus leucocephalus* | Threatened | Threatened |
| Bank swallow *Riparia riparia* | | Sensitive |
| Ferruginous hawk *Buteo regalis* | Species of Concern | Sensitive |
| Harlequin duck *Histrionicus histrionicus* | Species of Concern | Sensitive |
| Mountain quail *Oreortyx pictus* | Proposed threatened | |
| Northern goshawk *Acipiter gentilis* | Species of Concern | Sensitive |
| Northern spotted owl *Strix occidentalis caurina* | Threatened | Threatened |
| Olive-sided flycatcher *Contopus cooperi* | Species of Concern | |

| Species | Federal Listing Status | Oregon Listing Status |
|---|---|---|
| Tricolored blackbird *Agelaius tricolor* | Species of Concern | Sensitive |
| Western barrowing owl *Speotyto cunicularia hypagea* | Species of Concern | Sensitive |
| **Mammals** | | |
| California bighorn *Ovis Canadensis californiana* | Species of concern | |
| California wolverine *Gulo gulo luteus* | Species of Concern | Threatened |
| Pacific fisher *Mertes pennanti pacifica* | Species of Concern | Sensitive |
| Long-eared myotis *Myotis evotis* | Species of Concern | Sensitive |
| Long-legged myotis *Myotis volans* | Species of Concern | Sensitive |
| Pale western big-eared bat *Plecotus townsendii pallescens* | Species of Concern | Sensitive |
| Pygmy rabbit *Brachlagus idahoensis* | Species of Concern | Sensitive |
| Small-footed myotis *Myotis cilolabrum* | Sepcies of Concern | Sensitive |
| Yuma myotis *Myotis yumanensis* | Species of Concern | Sensitive |

## ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. Species List Attached

**(Anadromous salmonid effects are addressed in Section 2)**

**15.1) List all ESA permits or authorizations for all non-anadromous salmonid programs associated with the hatchery program.**

NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin 1999.
Intra-Service Section 7 Biological Evaluation Form, July 1998

**15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.**

The listing status of wildlife species in the lower Deschutes river subbasin is found in Attachment C.

Bull Trout (*Salvelinus confluentus*)

Bull trout in the Warm Springs River are part of the Columbia River distinct population segment that was listed as a threatened species in 1998. Bull trout in the Warm Springs River and Shitike Creek are considered to be at a moderate risk of extinction (Buchanan et al. 1997). Bull trout in general prefer cold water streams with temperatures below 15 degrees C (Reiman and McIntyre 1993). The CTWSRO are currently conducting population, distribution, and life history surveys for bull trout in the Warm Springs River and Shitike creek. Preliminary information indicates that bull trout spawn and rear in the upper reaches of both the Warm Springs River and Shitike Creek, while using the lower portions primarily as migration corridors between the Deschutes River and the spawning areas. It appears that there may be a resident adult bull trout population that does not migrate down to the Deschutes River but instead spends its entire life in the Warm Springs River and Shitike Creek (Chris Brun CTWSRO pers. comm.) Upstream migration of adult bull trout from the Deschutes River into the Warm Springs River occurs from May through July (CRiS Database 03/18/02). A similar upstream migration occurs in Shitike Creek. Bull trout typically spawn in the fall, with fry hatching out in late winter or early spring. The bull trout studies being conducted by the CTWSRO are expected to provide more information about the life history characteristics of bull trout in the Warm Springs River, Shitike Creek, and Deschutes River. Surveys conducted by ODFW in 2001 found a limited amount of overlap between juvenile spring Chinook and juvenile bull trout in Shitike Creek. The ODFW surveys found relatively low densities of juvenile spring Chinook salmon in the upper sections of Shitike Creek despite a relatively high density (2.7 redds/km) of Chinook redds. Juvenile Chinook salmon were found predominantly in the lower sections of the creek while juvenile bull trout were found primarily in the upper sections. Larger bull trout were found in both the upper and lower sections. Temperature is believed to be one of the factors that segregates juvenile bull trout and juvenile spring Chinook salmon in these stream reaches (Dambacher 2002).

Table 15.2 Monthly upstream passage of adult bull trout through the adult fish ladder at Warm Springs National Fish Hatchery. Bull trout numbers were not collected prior to 1993 (CRiS Database 3/18/02).

| Year | May | June | July | Total |
|---|---|---|---|---|
| 1993 | 1 | 0 | 0 | 1 |
| 1994 | 2 | 0 | 0 | 2 |
| 1995 | 1 | 2 | 2 | 5 |
| 1996 | 4 | 1 | 0 | 5 |
| 1997 | 4 | 3 | 0 | 7 |
| 1998 | 3 | 4 | 0 | 7 |
| 1999 | 2 | 11 | 0 | 13 |
| 2000 | 9 | 18 | 1 | 28 |
| 2001 | 22 | 3 | 0 | 25 |

## 15.3) Analysis of effects.

Bull Trout (*Salvelinus confluentus*)

Incidental take of bull trout could occur through activities associated with the Warm Springs NFH adult collection facility and hatchery operations. A fish barrier dam, adjacent to the hatchery, blocks upstream passage of all fish and directs them into a fish ladder located at the hatchery. Upon entering the fish ladder, fish are either directed into holding ponds or passed upstream through a fish ladder and around the barrier dam. An automated fish passage system is used during the spring Chinook salmon migration period, generally from May through the end of September. The automated passage system is designed to minimize handling of wild fish by passively separating returning hatchery spring Chinook salmon, identified by coded-wire tags, from wild fish. The passage system uses a 15-foot long denil steeppass fish-way with a coded-wire tag tube detector and gate. As fish swim through the fish-way and tube detector, coded-wire tagged fish are detected and a gate opens that shunts them into a holding pond. Non coded-wire tagged fish do not trigger the gate and are able to continue migrating up through the fish ladder and upstream of the barrier dam. A video system records non-coded wire tagged fish as they pass upstream of the hatchery. The video system allows hatchery personnel to monitor the number, species, and origin of fish passing upstream. During operation of the automated passage system, wild fish are not handled by hatchery personnel, thereby reducing the potential take of listed species. Migrational delay as fish find their way into the fish ladder and through the passage system, rejection of the fish ladder resulting in displaced spawning, and injuries suffered as adults try to jump the barrier dam could result in the incidental taking of adult bull trout.

The automated passage system is only used during the spring Chinook salmon migration period, generally from 15 April to 30 September. The proper functioning of the passage system relies on 100% coded-wire tagging of hatchery fish, with all non coded-wire tagged fish passed upstream. If the passage system allows too many hatchery spring Chinook salmon upstream (approximately 10% of the wild population), the passage

system is shut down and fish are sorted by hand. All spring Chinook salmon juveniles released from Warm Springs NFH are coded-wire tagged but stray hatchery fish from hatcheries outside the subbasin may not be coded-wire tagged. The Warm Springs River, and the Deschutes River subbasin in general, has a high incidence of stray hatchery steelhead (Olson and Pastor 1998). In order to preserve the genetic integrity of wild steelhead in the Warm Springs River, it is the policy of Warm Springs NFH to pass only wild (unmarked) steelhead above the barrier dam. In order to accomplish this goal, the automated fish passage system is not used until the steelhead migration has ended, usually sometime in late April. During the steelhead migration period or during other times when the passage system is not operating, fish find their way into the fish ladder and into a holding pond. Hatchery personnel then hand sort the fish. Fish are anesthetized with MS-222, sorted, measured, and then either passed upstream or collected for the hatchery. All wild summer steelhead, bull trout, and other indigenous fish species are then passed upstream.

Prior to 1991, adult bull trout that entered the fish ladder during the steelhead and spring Chinook salmon spawning migration were removed from the fish ladder and killed at the hatchery, as requested by CTWSRO. During other times of the year, approximately October through early February, the fish ladder was left open and fish were able to swim upstream without being diverted into the hatchery. The number of adult bull trout that were intentionally removed from the fish ladder is estimated to be between zero and three fish per year. Hatchery operation plans since 1991 have recognized bull trout as an important species and have identified the need to pass all native fish upstream of the hatchery. While unintentional lethal take at the hatchery could occur as a result of mishandling or mechanical malfunctions associated with the sorting process, no lethal take of bull trout has been recorded at the hatchery since 1991 (CRiS database 3/18/02). Take Table 3 outlines a worst case scenario of the lethal take of one adult bull trout per year as a result of mishandling or mechanical failures at the hatchery. If the automated passage system is not being operated, fish may be held in the holding ponds for up to 48hrs before sorting, potentially resulting in a delay of the upstream migration of bull trout.

The water source for the hatchery is the Warm Springs River. All water rights on the Warm Springs River are the property of the CTWSRO. Non-consumptive water use is included in the business lease between the CTWSRO and the USFWS. The intake structure and pumps are located at the hatchery site just upstream of the barrier dam. Water is pumped from the reservoir behind the barrier dam. Water is pumped to the hatchery ponds after passing through a trash rack and a traveling screen. Directly in front of the traveling screen is a fish bypass which is designed to divert small fish away from the screen and below the barrier dam. The Integrated Hatchery Operations Team noted that the current 3/16th inch mesh does not meet the 1/10th inch standard for screening facilities (IHOT 1996). It is suspected that juvenile fish are entering the hatchery ponds through the intake structure at the hatchery. Juvenile steelhead (or juvenile rainbow trout) and sucker sp. have been observed in the rearing ponds. No bull trout have been recorded in the rearing ponds. The Warm Springs NFH Implementation Plan (CTWSRO and

USFWS 2002) identifies the need to replace the water intake structure to meet NMFS Hatchery Biological Opinion criteria.

Monitoring activities associated with the Warm Springs spring Chinook salmon program also have the potential for incidental take of bull trout. A rotary screw trap, located at approximately Rkm 5 of the Warm Springs River, is operated by the CTWSRO in order to gather outmigration timing and population estimates for juvenile spring Chinook salmon. The trap is typically operated from mid-March through mid-November. Juvenile spring Chinook salmon collected at the trap are anesthetized with MS-222, measured, weighed, and a subsample are marked and released upstream for mark-recapture population estimates. Some juvenile spring Chinook salmon may be implanted with radio-tags in order to monitor migration behavior in the Deschutes River (See Section 12 and Attachment A). Listed juvenile steelhead and bull trout are also collected at the trap. The probability of capture for juvenile bull trout in the trap is low, with fewer than ten fish trapped per year (Bob Spateholts, CTWSRO Warm Springs, pers.comm.). If juvenile bull trout are collected at the trap they will be weighed, measured, marked, and released upstream. No mortalities of juvenile bull trout have been recorded at the juvenile trap (Bob Spateholts, CTWSRO Warm Springs, pers.comm.). Although unlikely, unintentional lethal take of juvenile bull trout could occur through mishandling during trapping or handling (see Take Table 3).

The USFWS expects to conduct research and monitoring activities at the hatchery and in the stream environment that will focus on the ecological interactions of hatchery and wild fish in the Warm Springs River, Shitike Creek, and Deschutes River. The research and monitoring program is intended to gather information that will help managers evaluate hatchery practices and reduce impacts of the hatchery program on wild fish populations. Proposed research activities associated with Warm Spring NFH are discussed in detail in Section 12. Sampling of spring Chinook salmon will occur through the normal hatchery and monitoring activities on the Warm Springs River and no additional trapping of fish is expected as a result of the research program. Incidental take associated with the research program is expected to be minimal. Up to 100 juvenile spring Chinook will be implanted with radio-tags at the rotary screw trap on the Warm Springs River. Other research activities on the Warm Springs River include expanded redd surveys and tissue sampling for genetic pedigree analysis of hatchery spring Chinook salmon at the Warm Springs NFH. Adult bull trout may be observed or unintentionally harassed during redd surveys as personnel walk sections of the Warm Springs River and its tributaries.

The USFWS and the CTWSRO also anticipate conducting monitoring and research activities on Shitike Creek. Shitike Creek is a small tributary of the Deschutes River that is located on the Warm Springs Reservation. Starting in 2000, the USFWS and the CTWSRO have outplanted Warm Springs NFH adult spring Chinook salmon into Shitike Creek (see Section 7). The objectives of the monitoring and research program are to 1) evaluate the contribution of outplanted spring Chinook salmon to the natural production in Shitike Creek, and 2) investigate the potential ecological interactions of spring Chinook, bull trout, and summer steelhead in Shitike Creek. The full study proposal is found in Attachment B. As part of the monitoring program, adult spring Chinook salmon

will be sampled at a temporary weir located near the mouth of Shitike Creek. The temporary weir is operated by the CTWSRO as part of a bull trout monitoring program funded by the Bonneville Power Administration. The weir is typically installed in late April or early May, after the main upstream migration of adult summer steelhead. Adult fish migrating upstream are trapped at the weir and sampled by CTWSRO personnel. Sampling includes taking length measurements and scale samples. As part of the spring Chinook program, tissue and scale samples will be collected from all upstream migrating spring Chinook. Incidental take of adult bull trout may occur at the weir as a result of handling stress or delayed migration. Unintentional lethal take of adult bull trout at the weir (resulting from stress or high water temperatures) is not anticipated.

Juvenile sampling of downstream migrating fish occurs at a rotary screw trap located near the mouth of Shitike Creek in the town of Warm Springs. The screw trap is operated when flows are sufficient, typically from March through June and from October through November. The CTWSRO operates the trap as part of the spring Chinook salmon monitoring program and a Bonneville Power Administration funded bull trout study. Procedures for operating the Shitike Creek screw trap are the same as for the Warm Springs River screw trap. The monitoring program in Shitike Creek will collect tissue samples (fin clips) from approximately 1000 juvenile spring Chinook salmon captured at the trap. No additional take of listed species is anticipated as a result of the spring Chinook sampling. The USFWS and the CTWSRO will also conduct snorkel surveys and juvenile sampling in Shitike Creek during July and August. Snorkel surveys will collect observational data on microhabitat preference, species association, and species interaction for juvenile salmonids and resident trout. Snorkelers will enter a habitat unit and randomly select juvenile fish for observation. Microhabitat measurements such as focal depth, cover type, substrate type, and distance to shore will be taken for each observed fish. During microhabitat measuring fish are expected to be temporarily displaced from their holding area as a result of their predator avoidance instinct (see Take Table 4). Snorkelers will not handle any fish during the surveys.

In addition to the microhabitat evaluation and population estimates, genetic tissue samples will be collected from age 0+ spring Chinook salmon during the summer. It is anticipated that age 0+ spring Chinook salmon will be collected using minnow trapping or seining techniques. Block nets will be placed at the upstream and downstream ends of selected habitat units. Minnow traps will be placed in slow water habitats, approximately four meters apart. The traps will be baited with canned tuna or cat food and allowed to fish for approximately 45 minutes. The traps will then be checked and all fish in the traps will be removed and placed in live wells downstream of the habitat unit. This process will be repeated until the juvenile Chinook catch approaches zero. Fin clips will be collected from juvenile Chinook and all fish will then be returned to the habitat unit and the block nets will be removed. The feasibility of seining juvenile Chinook salmon will be investigated. Snorkelers will enter the stream and "herd" spring Chinook salmon towards a seine, where they will be collected and sampled. Incidental take may occur as a result of harassment or stress associated with collection or snorkelers "herding" fish towards a seine. Juvenile sampling will not occur in areas where a high abundance of listed species are found.

Bald eagle *Haltaeetus leucocephalus*

The potential effect of hatchery operations on bald eagles is not known at this time. Eagles have been observed feeding on adult spring Chinook salmon in Shitike Creek (Bob Spateholts, CTWSRO Warm Springs, pers. comm.). Hatchery produced fish are likely part of the food source for eagles in the Warm Springs and Deschutes River subbasins. The effects of feeding on fish that may contain small amounts of MS-222, erythromycin, or other chemicals used at the hatchery are not known. Bald eagles in the Warm Springs recovery zone have shown an increasing trend in productivity during the past five years, with a productivity rate in 2002 of 1.11 young per occupied nest (Frank Isaacs, Oregon State Cooperative Fish and Wildlife Research Unit, pers. comm.).

## 15.4 Actions taken to minimize potential effects.

On-site hatchery operations and procedures are designed to minimize potential effects on listed species. Use of the automated fish passage system is expected to minimize handling stress and migration delay for wild fish, including adult bull trout. The automated passage system is generally operated from April 15 to September 30, during which time the majority of adult bull trout are migrating upstream past the hatchery (see table 15.2). When the automated system is not used, fish entering the fish ladder are sorted by hand (see Section 15.3). Hatchery personnel attempt to minimize handling stress on fish by following the appropriate fish handling guidelines and minimizing the amount of time fish are out of the water. The need to modify the screen on the water intake structure at the hatchery in order to meet NMFS Hatchery Biological Opinion criteria has been identified in the Warm Springs NFH Operational Plan and Implementation Plan (CTWSRO and USFWS 2002).

Incidental take of bull trout may occur as a result of the monitoring and evaluation activities associated with Warm Springs NFH (see Section 12 and Section 15.3). Procedures associated with the juvenile traps on the Warm Spring River and Shitike Creek are designed to minimize stress and potential take of listed species. The traps are checked regularly in order to minimize the amount of time fish are held at the trap. The amount of time fish are under anesthetic is carefully monitored and fish are allowed sufficient time to recover before being released back into the river. Direct take of listed species at the screw trap could occur as a result of trap malfunction or predator intrusion. The CTWSRO have observed mink predation on fish held in the screw trap (Bob Spateholts, CTWSRO Warm Springs, pers. comm.). During periods of high flows debris may clog the rotary screw mechanism or live box, possibly resulting in descaling or wounding of fish in the trap. Daily monitoring of the trap is expected to minimize take associated with trap malfunction or predator intrusion. If high flows are anticipated, the trap is raised in order to reduce the likelihood of trap malfunction. The adult weir in Shitike Creek will also be monitored on a daily basis. If water temperatures rise above the upper limit of bull trout preference (approximately 17 degrees C) pickets in the weir will be raised to allow fish to move upstream without entering the live box. The weir will be removed if any lethal take of bull trout occurs.

## 15.5 References

See section 13.

**Take Table 1**. Estimated steelhead take levels in the Warm Springs River for hatchery monitoring activities.

| **Listed species affected: Steelhead ESU/Population: Mid-Columbia ESU Activity: Hatchery Monitoring** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Warm Springs River Dates of activity: January 1-December 31**<br>**Hatchery program operator: USFWS Hatchery Operation + Monitoring, CTWSRO Monitoring** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | Egg/Fry | Juvenile/Smolt[1] | Adult | Carcass |
| **Observe or harass a) Hatchery fish ladder**<br>**CTWSRO spawning surveys** | - | - | <700<br><700 | <25 |
| **Collect for transport b)** | - | - | - | - |
| **Capture, handle, and release c)** | - | <8,000 | 50-700 | - |
| **Capture, handle, tag/mark/tissue sample, and released)** | - | <1,000 | - | - |
| **Removal (e.g. broodstock) e)** | - | - | - | - |
| **Intentional lethal take f)** | - | - | - | - |
| **Unintentional lethal take g)** | - | <50 | <5 | - |
| **Other Take (specify) h)** | - | - | - | - |

[1] Juvenile steelhead and juvenile resident rainbow trout are visually indistinguishable and are combined for estimated take purposes

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

**Take Table 2**. Estimated steelhead take levels in Shitike Creek for hatchery monitoring activities.

| **Listed species affected: Summer Steelhead ESU/Population: Mid-Columbia River ESU Activity: Hatchery Monitoring** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Shitike Creek Dates of activity: March 1-October 31 Hatchery program operator: USFWS** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | Egg/Fry | Juvenile/Smolt[1] | Adult | Carcass |
| **Observe or harass a)** | - | 2,000 | 200 | 50 |
| **Collect for transport b)** | - | - | - | - |
| **Capture, handle, and release c)** | - | 8,000 | <10 (kelts) | - |
| **Capture, handle, tag/mark/tissue sample, and released)** | - | 2,000 | - | - |
| **Removal (e.g. broodstock) e)** | - | - | - | - |
| **Intentional lethal take f)** | - | - | - | - |
| **Unintentional lethal take g)** | - | <50 | - | - |
| **Other Take (specify) h)** | - | - | - | - |

[1] Juvenile steelhead and juvenile resident rainbow trout are visually indistinguishable and are combined for estimated take purposes.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

**Table 3**. Estimated bull trout take levels in the Warm Springs River for monitoring activities.

| **Listed species affected: Steelhead ESU/Population: Mid-Columbia ESU Activity: Hatchery Monitoring** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Warm Springs River Dates of activity: January 1-December 31**<br>**Hatchery program operator: USFWS Hatchery Operation + Monitoring, CTWSRO Monitoring** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | Egg/Fry | Juvenile/Smolt | Adult | Carcass |
| **Observe or harass a) Hatchery fish ladder**<br>**CTWSRO spring Chinook salmon spawning surveys** | - | - | <25<br><10 | - |
| **Collect for transport b)** | - | - | - | - |
| **Capture, handle, and release c)** | - | - | - | - |
| **Capture, handle, tag/mark/tissue sample, and released)** | - | <20 | <25 | - |
| **Removal (e.g. broodstock) e)** | - | - | - | - |
| **Intentional lethal take f)** | - | - | - | - |
| **Unintentional lethal take g)** | - | <2 | <2 | - |
| **Other Take (specify) h)** | - | - | - | - |

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

**Take Table 4**. Estimated bull trout take levels in Shitike Creek for hatchery monitoring activities.

| **Listed species affected: Bull Trout ESU/Population: Columbia River Population Segment Activity: Hatchery Monitoring** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Shitike Creek Dates of activity: March 1-October 31 Hatchery program operator: USFWS** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*[1]** | | | |
| | Egg/Fry | Juvenile/Smolt | Adult | Carcass |
| **Observe or harass a)** | - | <150 | <25 | - |
| **Collect for transport b)** | - | - | - | - |
| **Capture, handle, and release c)** | - | <100 | - | - |
| **Capture, handle, tag/mark/tissue sample, and released)** | - | <75 | - | - |
| **Removal (e.g. broodstock) e)** | - | - | - | - |
| **Intentional lethal take f)** | - | - | - | - |
| **Unintentional lethal take g)** | - | <3 | <2 | - |
| **Other Take (specify) h)** | - | - | - | - |

[1]Take levels are for monitoring activities in Shitike Creek. Activities include the operation of a rotary screw trap, steelhead and spring Chinook spawning surveys, and snorkel surveys for juvenile population estimates and habitat preferences.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.